Gillespie Field Annex Reference

of the

San Diego Air & Space Museum

June, 2020

For reference only

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PURPOSE of the Gillespie Field Annex Reference

This Gillespie Annex Reference is designed to be a quick reference for Museum staff, volunteer and docents. It is an accumulation of information found in several different information sources. It is organized to provide the reader a single document with which to view basic information about the Gillespie Field artifacts.

There is no attempt to provide extensive detailed information about each display. Rather, the Gillespie Annex Reference attempts to provide sufficient information to the reader so they may inform and entertain museum guests with interesting information to inspire, educate and celebrate aviation/space flight history and technology. Personal reading and research into additional technical and historical aviation/space information is encouraged.

The pages of the Museum Gallery Reference are laid out to show a first page with a PICTURE of the museum's artifact, along with some KEY POINTS text about the artifact. On the second page is a picture of the artifact's STORY BOARD (if there is one) and occasionally EXTRA INFO about the artifact.

The 'Key Points' and 'Extra Info' text included on these pages are from: Artifact 'story boards', SDASM Commercial Guidebook, SDASM Docent Training Guide, SDASM Website, the Smithsonian Website and footnoted websites.

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INTRODUCTION

Paper Version - The colored top bar on each page is to assist in finding a specific display or work area (Out Front, Flight Line, Hangar 1, etc.) in the Museum Gallery Reference quickly. The colors are duplicated in the paper copy of the Museum Gallery Reference Table of Contents (TOC).

Electronic version - has an interactive TOC. By touching or clicking on an artifact's name in the TOC, you will be taken to the artifacts page. To return to the TOC, touch or click on the "Back to TOC" link at the bottom right corner of each page.

There are several categories of artifacts exhibited in the Museum:

1. **Originals** were produced by the original manufacturers (e.g. Deperdussin and Supermarine Spitfire).
2. **Replicas** are vehicles built where the original was built, by at least some of the people who participated in building the original. All of the major internal and external features of the craft are faithfully duplicated in a replica (e.g. Spirit of St Louis).
3. **Reproductions** also duplicate internal and external features, and often are as accurate and important as replicas, but aren't necessarily built where the original was, or by any original craftsmen.
4. **Mock-ups** are only accurate enough to provide the viewer with the size, shape, colors, and major external features of the original (e.g. Mercury capsule and X-1).
5. **Models** are similar to mock-ups, but are often built in a different scale than the original (e.g. Global Hawk and Montgolfier Balloon). Non-originals are used in the Museum to illustrate significant aircraft when originals don't exist, were unaffordable, or would not fit in the galleries (e.g. B-17 and B-24).

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GILLESPIE FIELD ANNEX
HISTORY

In 1984, the SDASM moved most of it's restoration, preservation, and reproduction facilities into the 10,000 square foot hangar at Gillespie Field in El Cajon. This storage and restoration facility is located at the north eastern corner of the airport and visitors can view various aircraft in the SDASM collection.

Numerous examples of military jets, turbo-props, helicopters, aircraft engines, sport and racing aircraft and even a few rockets and missiles are stored and displayed here.

The Restoration Shops at Gillespie, like those in the basement of the main museum building, only larger, are staffed by highly skilled volunteers. In addition to repairing and/or restoring various historic aircraft, they are able to build planes from scratch, which they did with the splendid Boeing P-26 Peashooter at Balboa Park and the Sopwith Pup on display in Hangar 1.

The Model Shop produces incredible models (B-17, B-24) for display to illustrate significant aircraft when originals don't exist, were unaffordable, or would not fit in the Museum's Galleries.

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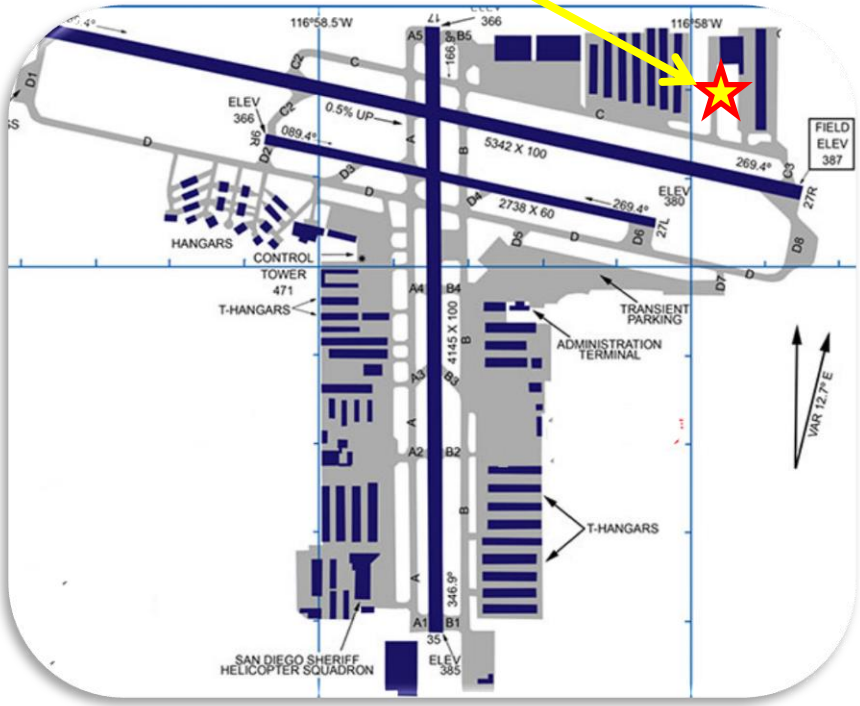
Gillespie Field Annex

SDASM Gillespie Field Annex



Key Points:

1942 - Camp Gillespie, Marine Corps developed parachute training area on 688 acres east of San Diego. Named for Lt. Archibald H. Gillespie, USMC, who played a prominent role in separating California from Mexico in 1840s.

1944 - Camp commissioned as Marine Corps Auxiliary Airfield Gillespie. Trained VMSB-141 who in Aug, 1942, deployed to Guadalcanal as part of the "Cactus Airforce".

1946 - Became a General Aviation airport.

1952 - San Diego County granted ownership of Gillespie Field.

1983 - San Diego Aerospace Museum located its restoration operations and an exhibit at the Northeast corner of the field.

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Gillespie Field Annex

Photo - 1984

Photo - 2020

Extra Info: During the 1980s, the Museum grew from 25 aircraft to over 80. In **1984, the Museum expanded its space and collection by opening a 10,000 square foot hangar** at Gillespie Field, El Cajon, as seen in the left photo above. The site opened to the public on **August 10, 1985**. The Gillespie site serves as a storage and restoration facility. **Currently, over 60 aircraft in the Museum's collection are stored here**, including military jets, helicopters, private sport aircraft and small racing planes. The Gillespie restoration shops, like the one in the basement of the main Museum building, are staffed by highly skilled volunteers. In addition to repairing various historic aircraft, they are able to build complete and authentic reproduction aircraft. During the 1990s, another expansion occurred at the Gillespie Field facility when **Convair/General Dynamics donated a hangar, as seen in the right photo above, doubling the facilities covered storage capacity from 10,000 square feet to 20,000 square feet.**

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Out Front

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Out Front

Aurora 7 (Carpenter) Mercury launch

1st Space Mission Flight: 1958

Key Points: General Dynamics Atlas 2E (Original) **First operational U.S. inter-continental ballistic missile (ICBM);** first of the Atlas launch vehicle family. First space mission launched the SCORE communication satellite into orbit, Dec, 1958 (broadcasted Christmas message from President Eisenhower). **Atlas 3D used as space launch vehicle for Mercury 7 Astronauts Program. Alan Shepard was the first to fly (suborbital) and John Glenn was the first to orbit the earth. Also placed Mercury Astronauts; Carpenter, Schirra & Cooper into orbit.**

This: Built by Convair Division of General Dynamics at Kearny Mesa, San Diego. Donated to SDASM and on Mar 11, 1996, was erected for display at Gillespie Field.

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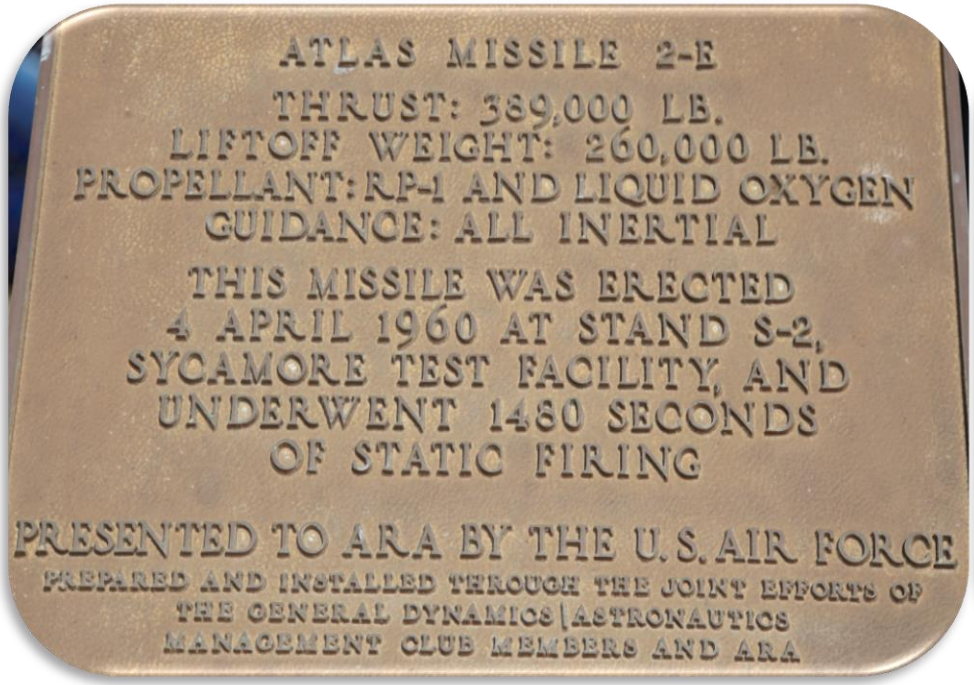
Out Front

TECHNICAL DATA	
MANUFACTURER:	General Dynamics Convair Division
POWERPLANT:	One Rocketdyne LR105 rocket engine with 57,000 lbf thrust, two Rocketdyne LR89 rocket engines with 150,000 lbf thrust, two Rocketdyne LR101 vernier rocket engines with 1,000 lbf of thrust.
LENGTH:	75 ft. 10 in. (85 ft. 6 in. in ICBM configuration)
DIAMETER:	10 ft. (not including strap-on boosters)
WEIGHT:	260,000 lbs maximum at launch
YEARS BUILT:	1959-1965


ATLAS MISSILE 2-E
THRUST: 389,000 LB.
LIFTOFF WEIGHT: 260,000 LB.
PROPELLANT: RP-1 AND LIQUID OXYGEN
GUIDANCE: ALL INERTIAL
THIS MISSILE WAS ERECTED
4 APRIL 1960 AT STAND S-2,
SYCAMORE TEST FACILITY, AND
UNDERWENT 1480 SECONDS
OF STATIC FIRING
PRESENTED TO ARA BY THE U.S. AIR FORCE
PREPARED AND INSTALLED THROUGH THE JOINT EFFORTS OF
THE GENERAL DYNAMICS | ASTRONAUTICS
MANAGEMENT CLUB MEMBERS AND ARA

NATIONAL HISTORIC
MECHANICAL ENGINEERING LANDMARK
ATLAS SPACE BOOSTER FAMILY
SAN DIEGO, CALIFORNIA
1957
THE BASIC CONCEPT OF THE TOTAL ATLAS SYSTEM, DEVELOPED AS THE FREE WORLD'S FIRST ICBM, WERE PROVEN BY THE PIONEER ATLAS FLIGHT ON JUNE 11, 1957. THE ATLAS FAMILY EVOLVED RAPIDLY INTO THE HIGHLY SUCCESSFUL SPACE BOOSTER OF TODAY. NEARLY 500 LAUNCHES TO DATE HAVE INCLUDED THE FIRST COMMUNICATIONS SATELLITE (1958), THE FIRST AMERICAN IN ORBIT (1962) AND A WIDE VARIETY OF EARTH ORBITAL AND INTERPLANETARY MISSIONS WHICH TOGETHER GREATLY ADVANCED OUR KNOWLEDGE OF THE UNIVERSE.
DEVELOPED BY GENERAL DYNAMICS CONVAIR
AND THE U.S. AIR FORCE
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS - 1985

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Out Front

Key Points: **TWA B-727 Flight Simulator** (Original) Used as a **less expensive and more efficient method to train and test flight crews**. B-727 cost/hr for aircraft ≈ $7700, simulator ≈ $1200. Examiners and instructors can safely expose crews to emergencies and abnormal conditions in a simulator. Example: Engine failure in the aircraft can only be simulated by reducing engine throttle to idle; instruments continue to show an operating engine. **In a simulator, when the instructor fails an engine, the instruments and flight characteristics are nearly identical to an actual aircraft engine failure, greatly enhancing training.**

This: Obtained from Embry-Riddle Aeronautical Univ. in Prescott AZ.

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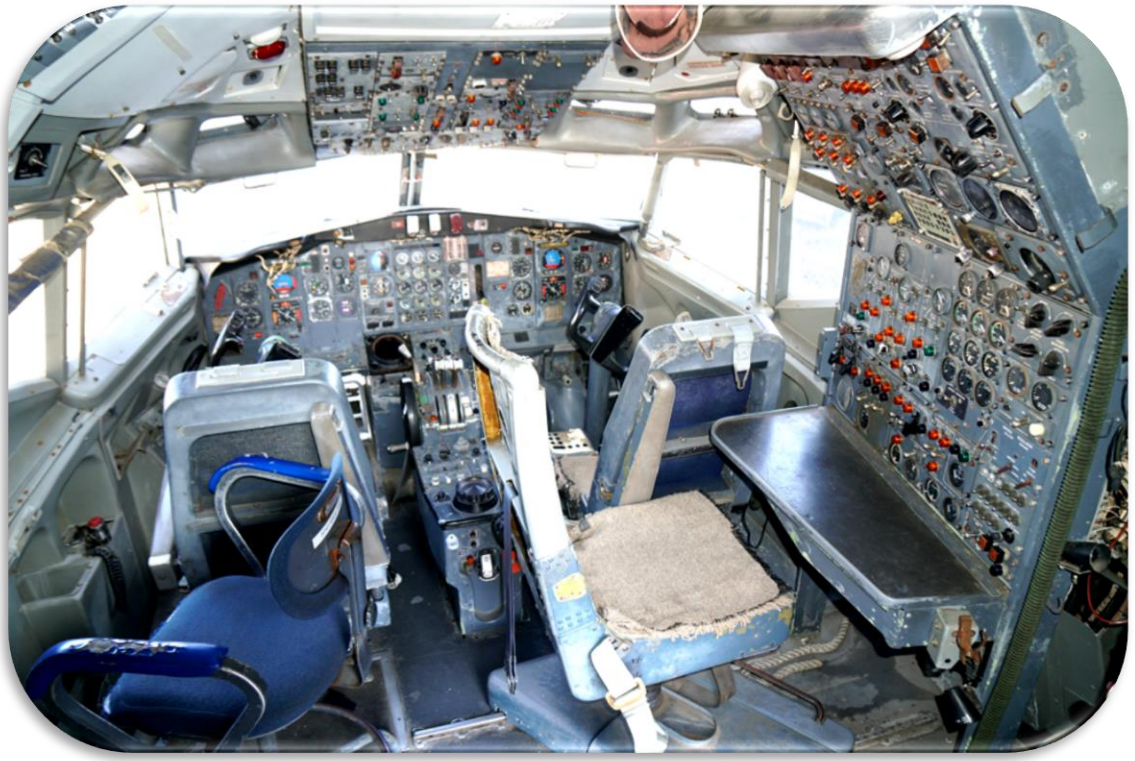
Out Front



Key Points: On the left is where the **instructor or checkairman sits and controls the operation of the simulator**. They can induce failures or malfunctions of all aircraft systems (engines, generators, hydraulic, lubrication, fuel, etc.) into the training/checking syllabus. This provides a **"real world" simulation of aircraft operation**. The **pilot, co-pilot and flight engineer seats** (on the right) mimic an actual cockpit layout and operation. Simulator time may be credited as flight time (for training only).

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Out Front

1st Flight: Never-Never Land

-

Built: 1998

Key Points: **Spirit of San Diego** (**Original**) **Top Secret Experimental Supersonic, STL (short takeoff and landing) Autoplane.** Designed to transport the wayward Museum Staff or Volunteer out of danger. Requires special license to operate (issued only by **Disneyland**). Operators must be **under 15 or over 60 years of age** to opera the Spirit.

This: (part is true) The "Spirit" was built on a Citroen chassis (Contracted by Forged Metals, Inc. Fontana, CA), as a mobile advertising vehicle. Designed by Garry Frazer; built by Clifford Cappos and SDASM Volunteers, it was originally named "Spirit of Fontana" and made its debut at the 1999 Paris Air Show at Le Bourget. Donated by Firth Rixon, Forged Metals, Inc. and renamed "Spirit of San Diego".

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Out Front

Extra Info: Shown here reportedly ready for transport to a foreign country for a black ops mission ordered by an unnamed government agency. **Sources close to the White Houser** (Henry's Pub and Billiard Hall, 1730 Pennsylvania Ave NW), revealed that SDASM would be compensated a **first round draft pick and an undisclosed donation** for the loan of the Spirit.

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Out Front

1st Flight: 1962

Key Points: **Ryan Model 147 Fire Fly** (**Original**) a jet-powered drone, or **Unmanned Aerial Vehicle**, produced and developed by Ryan Aeronautical. **Designed for high altitude surveillance**. Built without landing gear for simplicity and to save weight. Could either be air-launched from a large aircraft or ground/ship launched using a solid rocket booster. At completion of its mission the **drone deployed a self-recovery parachute** which could be snatched in mid-air by a recovery aircraft. Firefly had a **1,200 mile range; cruise altitude of 55,000 feet**. Later versions up to 75,000 feet. Most versions used preprogrammed auto pilot for flight path and altitude. **Surveillance conducted with U-2 type high-resolution camera.** Used over Southern China, Vietnam and North Korea. Over **3400 combat missions** from 1964 until 1975.

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Out Front

RYAN DRONE
Ryan Model 147 reconnaissance drone, one of many types of San Diego-built Remotely Piloted Vehicles (RPVs) flown on intelligence-gathering missions over Southeast Asia (1964-1975).
Unmanned vehicles such as this are flown by remote control from locations hundreds of miles away without risking the lives of pilots who would otherwise have to fly into hostile environments.
This reconnaissance drone is but one example of the high technology aerospace products conceived and built by companies in the San Diego County — El Cajon Valley regions.
Dedicated
August 10, 1985

RYAN DRONE (Plaque)

Ryan Model 147 reconnaissance drone, One of many types of San Diego-built Remotely Piloted Vehicles (RPVs) flown on intelligence-gathering missions over Southeast Asia (1964-1975).

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Dedicated
August 10, 1985

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Out Front

1st Flight: 1947

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Mig 15 - 2 Wing Fences

-

MiG 17 – 3 Wing Fences

Key Points: Mikoyan-Gurevich MiG-15 (Original) one of the **first successful swept-wing jet fighters developed by USSR**, achieved fame in Korea. **Superior to Allied F-80 Shooting Star, inferior to F-86 Sabre Jet**. **MiG-15 is light weight, extremely maneuverable and has a rapid rate of climb. No after-burners, no radar, small air-brakes, sub-sonic, cannon only. Over 17,000 total produced**.

This: Fully operational and flown in 1985. Purchased from the People's Republic of China by the Champlin Fighter Museum (Mesa, AZ), then sold to SDASM. Same colors as when in service of Peoples Republic of China Air Force.

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MiG-15 TECHNICAL DATA
MANUFACTURER: Design Bureau of Mikoyan-Gurevich
POWERPLANT: One RD-45F turbo-jet rated at 5,005 lb. st
SPAN: 32 ft 11 in, Length: 33 ft 1 in, HEIGHT: 11 ft 2 in
CEILING: 51,000 ft
RANGE: 1100 mi
WEIGHT: Empty 7,456 lbs (gross, 11,070 lbs)
MAX SPEED: 668 mph
YEAR BUILT: 1951
ARMAMENT: 2X23 mm Cannon, 1X37 mm Cannon, 2X220 lb wing hardpoints
SERIAL NUMBER: 70201 (Chinese Air Force number)
REG. NUMBER: N4784

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Out Front

Key Points: **Boeing 377 Stratocruiser Cockpit Trainer** (**Original**) The **Boeing 377 Stratocruiser** (first flight: Jul, 1947) was a **large long-range airliner developed from the C-97 Stratofreighter** military transport, itself a derivative of the B-29 Superfortress. 377's design was advanced for its day; featured two passenger decks and **pressurized cabin**, however reliability was poor due to problems with the four 28-cylinder Pratt & Whitney R-4360 Wasp Major radial engines, structural issues and control problems with the engine propellers. **Only 55 Model 377s were built** for airlines, along with the single prototype.
This: **O**wned by David Lane, a friend of the museum. Attached to B-747 engine inlet to show size comparison.

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Out Front

Key Points: **Boeing 377 Stratocruiser Cockpit Trainer** Used as a **less expensive and more efficient method to train and test flight crews**. The cost to operate about 15% as much as the actual aircraft. Flight crew position are **Pilot, Co-Pilot and Flight Engineer** positions shown in left photo. **Navigator** position is to the left rear of the flight deck, shown in the photo on right. Flight crews can be **trained on flight deck familiarity; normal, emergency and abnormal procedures; checklist flows and flight deck crew proficiency**.

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Flight Line

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Flight Line

1st Flight: 1979

Key Points: **Sikorsky SH-60 Seahawk** (**Original**) is a **twin turboshaft engine, multi-mission US Navy helicopter based on the Army's UH-60 Black Hawk**. Modified with folding main rotor and a hinged tail to reduce its footprint aboard ships. Able to **deploy aboard any air-capable frigate, destroyer, cruiser, fast combat support ship, amphibious assault ship, or aircraft carrier**. The Seahawk can handle **anti-submarine warfare , anti-surface warfare, naval special warfare insertion, search and rescue, combat search and rescue, vertical replenishment, and medical evacuation.**

This: A very early prototype on loan from the US Navy.

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Key Points: SH-60 General characteristics

Crew: 3–4
Capacity: 5 passengers in cabin, slung load of 6,000 lb or internal load of 4,100 lb
Length: 64 ft 8 in (19.71 m)
Height: 17 ft 2 in (5.23 m)
Empty weight: 15,200 lb (6,895 kg)
Max takeoff weight: 23,000 lb
Powerplants: 2 × GE T700-GE-401C turboshaft engines, 1,890 shp each.
Main rotor diameter: 53 ft 8 in

Performance

Maximum speed: 146 kn (168 mph)
Never exceed speed: 180 kn (210 mph)
Range: 450 nm (520 mi)
Service ceiling: 12,000 ft

Armament

- Two Mk 46 or Mk50 or Mk54 torpedoes *or* two 120 U.S. gal fuel tanks.
- 4 Hellfire missiles for SH-60B and HH-60H and MH-60R, 8 Hellfire missiles for MH-60S.
- APKWS Advanced Precision Kill Weapon System.
- M60 machine gun *or*, M240 machine gun *or* GAU-16/A machine gun *or* GAU-17/A Minigun.
- Rapid Airborne Mine Clearance System with 30 mm Cannon.

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Key Points: **North American F-86F Sabre** (**Original**) First swept-wing U.S. fighter. **First supersonic flight 1948, set world speed record 670.981 mph**. GE J73-GE-3D engine. **10 to 1 loss ratio over MiG-15, dubbed "MiG Killer"**. **2540 F-86Fs were built** at plants in Los Angeles, California and Columbus, Ohio.

This: Painted in the colors of '*The Paper Tiger*' in honor of **Captain Harold Fischer**. One of the **few Sabres with shark mouth nose**. Captain Fischer, 39th Fighter Interceptor Squadron, Suwon, Korea, ended the war with **10 confirmed MiG kills** scored between November 26, 1952 and March 21, 1953.

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North American F-86F Sabre

U.S. Air Force Fighter

Serial Number:	55-5014
Period:	Korean War
Wingspan:	37' 1"
Length:	37' 6"
Height:	14' 9"
Crew:	Pilot
Max Speed:	679 mph at Sea Level
Service Ceiling:	47,200 '
Empty Weight:	10,093 lbs.
Maximum Gross Weight:	16,225 lbs.
Combat Range:	848 miles
Maximum bomb load:	2,000 lbs.
Armament.	Six 50 Cal. M-3 Machine Guns, 5-inch rockets.

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Flight Line

Key Points: **Convair F-102A Delta Dagger** (**Original**) **"The Deuce" First operational supersonic interceptor and delta-wing fighter in USAF**, entered service, 1956. Approximately **1,000 F-102s were built**. Carried both guided missiles and rockets. **Limited service in Vietnam War** in bomber escort and ground-attack roles. YF-102 went supersonic with a **maximum speed of 825 mph (mach 1.25)**. Retired from operational service in 1976.
This: Manufactured by General Dynamics, Convair Division in San Diego, 1956. Saw service in Keflavik, Iceland; Elmendorf Air Force Base, Alaska; Wisconsin ANG and Kelly Air Force Base as a static display. On loan from Kelly AFB. Displayed Gillespie in 2002. Painted in colors of Alaskan Air Command, 317th Fighter Intercept Squadron.

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Convair F-102A "Delta Dagger"

Built in San Diego in 1956-57

Serial Number:	56-1268
Period:	1950's - 1970's
Length:	68' 4" (including boom)
Width:	38' 1"
Height:	21' 2"
Crew:	Pilot
Max Speed:	825 mph @ 36,000'
Service Ceiling:	54,000'
Empty Weight:	19,360 lbs
Max Gross Weight:	31,559 lbs max
Combat Range:	1,000 miles
Armament:	24 unguided 2.75 inch rockets
	6 AIM-4 Falcon guided missiles

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Flight Line

1st Flight: 1970

Key Points: **Grumman A-6E Intruder** (**Original**) **World's first all-weather attack bomber capable of detecting and identifying tactical or strategic targets**. Could deliver both conventional and nuclear ordnance in all weather conditions. Extremely accurate, low-altitude, long-range, subsonic weapons system. Crew of two, pilot and bombardier-navigator. **445 Intruders build**.

This: Built by Grumman in 1988. Served at NAS Oceana, Virginia, *USS John F. Kennedy, USS Saratoga,* Naval Weapons Center, China Lake, CA. Navy crew flew from China Lake to Gillespie, 1994.

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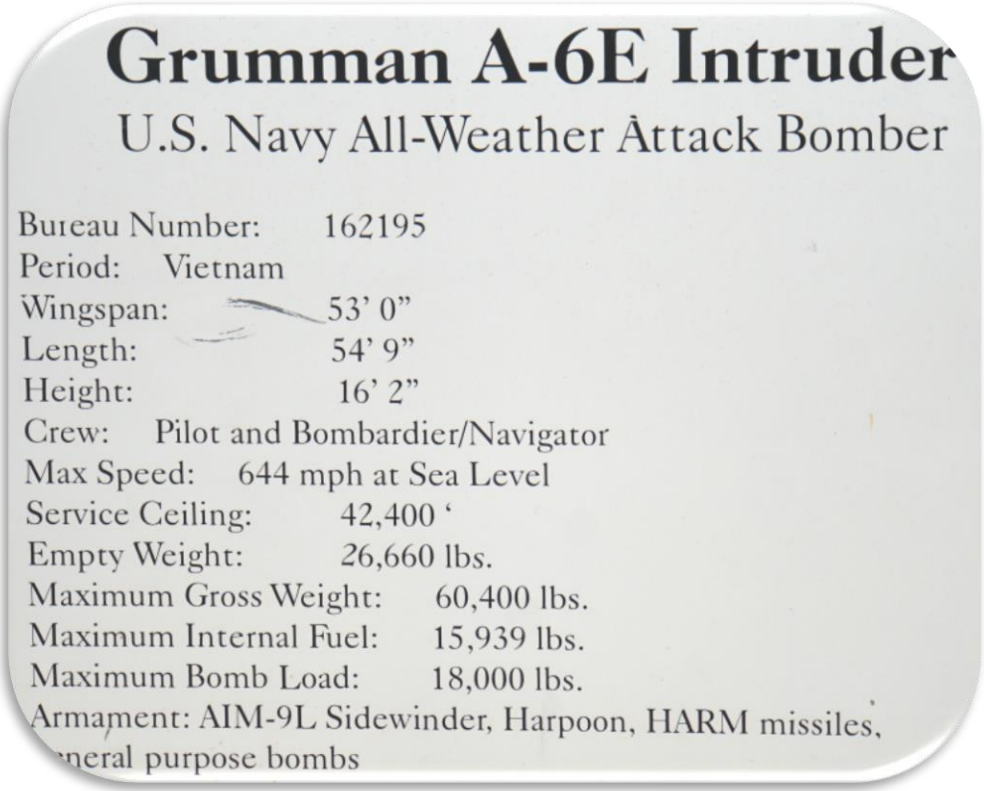
Grumman A-6E Intruder
U.S. Navy All-Weather Attack Bomber
Bureau Number: 162195
Period: Vietnam
Wingspan: 53' 0"
Length: 54' 9"
Height: 16' 2"
Crew: Pilot and Bombardier/Navigator
Max Speed: 644 mph at Sea Level
Service Ceiling: 42,400 '
Empty Weight: 26,660 lbs.
Maximum Gross Weight: 60,400 lbs.
Maximum Internal Fuel: 15,939 lbs.
Maximum Bomb Load: 18,000 lbs.
Armament: AIM-9L Sidewinder, Harpoon, HARM missiles,
neral purpose bombs

Extra: The A-6 is a **all-weather navigation** and **weapons delivery system** providing an **integrated electronic display which allows them to "see" targets and geographical features regardless of darkness or foul weather.** Primary job in Vietnam was the suppression of surface-to-air missiles, with the Navy's anti-radiation missile. The A-6C incorporated **electro-optical sensors to observe and attack vehicles at night**. The A-6E, featured **multi-mode radar** and improved computer. The Intruder was the **mainstay of the Navy and Marine Corps air arms for more than three decades** for close-air-support, interdiction, and deep-strike missions. It was configured for both Harm and Harpoon missiles, nuclear weapons and, with its radar and FLIR/ laser systems, could detect, classify and attack a full range of targets.

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Flight Line

1st Flight: 1965

Key Points: Vought A-7B Corsair II (**Original**) Nickname **"SLUF".** Designed as a **lightweight, low tech, carrier based attack aircraft**. First Vietnam combat in 1967. **One of 1st aircraft with heads-up display (HUD), inertial navigation system (INS), a turbofan engine and Forward-Looking-InfraRed (FLIR)**. **One of the most accurate strike aircraft ever built**; in Vietnam was successful in every attack role. A total of **1,545 A-7 Corsair IIs were built**. The last A-7 Cousair II was retired in 1991.

This: Bureau Number 154554, was delivered to the Museum in 1993; is on loan from the National Museum of Naval Aviation in Pensacola, Florida.

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LTV A-7B Corsair II

U.S. Navy Light Attack Aircraft

Period:	Vietnam, Desert Storm
Wingspan:	38' 9"
Length:	46' 1"
Height:	16' 0"
Crew:	Pilot
Max Speed:	698 mph at Sea Level
Service Ceiling:	43,000 '
Empty Weight:	18,942 lbs.
Maximum Gross Weight:	42,000 lbs.
Maximum Bomb Load:	15,000 lbs.

Armament: AIM-9L Sidewinder. M61A1 20mm Cannon AGM-45 Shrike. General Purpose bombs.

LTV is American conglomerate Ling-Temco-Vought.

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Flight Line

1st Flight: 1955

Key Points: **Vought F-8J Crusader** (**Original**) **Single-engine carrier-based air superiority jet** aircraft. **First Navy fighter exceeding 1000 mph** in level flight. **1957, Maj. John Glenn, flew a Vought F8 Crusader coast to coast in 3 hours, 23 minutes** ("Project Bullet" non-stop flight from Los Alamitos, CA to Floyd Bennett Field, NY), average speed of Mach 1.1, despite 3 in-flight refuelings. 4X20 mm cannons, rockets, sidewinder missiles. The "**fighter pilot's fighter**", the last of the "great gunfighters". **Highest kill ratio of any fighter in Vietnam**.
This: Entered Navy in 1961. Saw service with VF-211, VF-24 VF-191 and VF-194 and Pacific Missile Test Center, NAS Pt. Mugu, CA. In 1984, Navy North Island restored and donated aircraft to SDASM. (**Total 1267 built**)

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Vought F-8J Crusader

U.S. Navy Fighter

Bureau Number: 150297
Period: Vietnam
Wingspan: 35' 2"
Length: 54' 6"
Height: 15' 9"
Crew: Pilot
Max Speed: Mach 1.8, 1,120 mph at 40,000'
Service Ceiling: 58,000 '
Empty Weight: 18,824 lbs.
Maximum Gross Weight: 34,280 lbs.
Combat Range: 1,427 miles

Armament: AIM-9 Sidewinder, AGM-12 Bullpup missiles, 20mm Cannon, Zuni air-to-surface rockets, General Purpose bombs

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1st Flight: 1960

Key Points: **Hawker Siddeley AV-8A Harrier** (**Original**) **"Harrier Jump Jet", first generation of the Harrier series**. Designed as close-support & reconnaissance fighter with vertical/short takeoff and landing (V/STOL). AV-8B was produced by McDonnell Douglas. Falkland War, **Harriers shot down twenty Argentine aircraft without a single loss**. One 25mm 5 barrel cannon, 6 wing hard points. **551 Harriers of all kinds have been manufactured.**

This: Built by Hawker Siddeley in 1974. Shipped to US in 1975. Final assignment, Squadron 542 Cherry Point, NC. Retired 1986, moved to San Diego in 1999. Has 2,963.4 flying hours, 4,164 landings, and 140 months of service.

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McDonnell-Douglas AV-8A Harrier

U.S. Marine Corps Fighter-Bomber

Period:	Post Vietnam
Wingspan:	30' 4"
Length:	47' 9"
Height:	11' 8"
Crew:	Pilot
Max Speed:	661 mph at Sea Level
Service Ceiling:	43,000 '
Empty Weight:	13,968 lbs
Maximum Gross Weight:	31,000 lbs
Maximum Internal Fuel:	13,373 lbs

Armament: AIM-9L Sidewinder. AGM-65 Maverick missiles; 25mm Cannon, General Purpose bombs.

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Flight Line

1st Flight: 1974

Key Points: **General Dynamics F-16N Falcon** (**Original**) Single-engine supersonic multirole fighter aircraft, designed as air superiority day fighter, evolved into successful all-weather multirole aircraft and **adversary for the "Top Gun"** Naval Fighter Weapons School. **Over 4,600 aircraft have been built**. One 20mm Vulcan cannon and 11 locations for weapons/equipment. Official name: "**Fighting Falcon**", but "**Viper**" is commonly used by its pilots and crews. As of 2015, it's the **world's most numerous fixed-wing aircraft in military service.**

This: Was acquired from the Navy Fighter Weapons School at Miramar and put on display at Gillespie Field in 1995. The aircraft is on loan from the National Museum of Naval Aviation at Pensacola, Florida.

Back to TOC

General Dynamics F-16N

U.S. Navy Adversary Fighter

Period: Current Inventory
Wingspan: 31' 0"
Length: 49' 5"
Height: 16' 8"
Crew: Pilot
Max Speed: Mach 2.0+, 1,320 mph
Service Ceiling: 50,000 ' +
Empty Weight: 15,586 lbs
Maximum Gross Weight: 35,400 lbs
Maximum Internal Fuel: 16,972 lbs

Armament: AIM-7M Sparrow, AIM-9L Sidewinder, AGM-78 Standard ARM, AGM-45 Shrike missiles; M61 20mm Cannon, General Purpose bombs.

Back to TOC

Flight Line

1st Flight: 1970

Key Points: **Grumman F-14A Tomcat** (**Original**) A supersonic, twin-engine, variable sweep-wing, two-place fighter. Designed to **attack & destroy enemy aircraft at night and in all weather** conditions. The F-14 could **track up to 24 targets simultaneously** with its advanced weapons control system, and could attack 6 targets with Phoenix AIM-54A missiles, while continuing to scan the airspace. **Replaced the historic F-4 Phantom as the Navy's primary maritime air superiority fighter, fleet defense interceptor and tactical reconnaissance platform.** F-14 replaced by the F-18. Over **710 F-14's were built**.

This: Built in 1974. Assigned to VF-24 "Fighting Renegades" aboard the *USS Constellation*, *USS Ranger*, *USS Kitty Hawk* and *USS Nimitz (*during operation Southern Watch, where it flew over 800 sorties). In 1994, delivered to SDASM and put on display. Used by *KinoCheck International* for movie ***"Top Gun 2"*.** On loan from the National Museum of Naval Aviation, Pensacola, Florida.

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Grumman F-14A Tomcat

U.S. Navy Fighter

Period: Desert Storm
Wingspan: 64' 1" unswept, 38' 2" swept, 33' 3" oversweept
Length: 62' 8"
Height: 16' 0"
Crew: Pilot and Radar Intercept Officer
Max Speed (at 49,000'): Mach 2.4, 1,584 mph
Service Ceiling: 50,000 ' +
Normal Takeoff Weight: 58,714 lbs
Maximum Gross Weight: 74,349 lbs
Maximum Fuel Load: 16,200 lbs Internal 3,800 lbs External

Armament: AIM-54C Phoenix. AIM-7M Sparrow,
AIM-9M Sidewinder missiles. M61A1 20mm Cannon

Back to TOC

Flight Line

1st Flight: 1955

Key Points: **Mikoyan-Gurevich MiG-21** (**Original**) "**Fishbed**", is a supersonic jet fighter. Some **60 countries over four continents have flown the MiG-21**, and it still serves many nations 60 years after its maiden flight. A lightweight fighter, **achieved Mach 2** with a low-powered afterburning turbojet engine. Simple controls, engine, weapons and avionics along with very good stability and control, enhanced safety for lower-skilled pilots; this in turn enhanced its marketability to developing countries with limited training programs and restricted pilot pools. **Most-produced supersonic jet aircraft (11,496) in aviation history** and had the **longest production run of any combat aircraft** (1959 to 1985, now exceeded by the F-15 Eagle and F-16 Falcon).

This: This aircraft (s/n 75049099) retired from the Hungarian Air Force in 2001 and donated to the Museum by Connie Cole-Redick (President of Advanced Aviation Incorporated).

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Hungarian Air Force
Mikoyan MIG-21bis "Fishbed"

Period	1975 - 2001
Crew	Pilot
Engine	Tumansky R-25 300 Turbojet
Power	19,850 lb thrust (88.2 kN) w/afterburner
Wingspan	23.5 ft (7.16 m)
Length	51.75 ft (15.77 m)
Max Speed	2.1 MACH at 42,650 ft (12,795 m)
Service Ceiling	57,415 ft (17,500 m)
Combat Radius	175 NM (320 km)
Empty Weight	13,500 lb (6,200 kg)
Max Gross Weight	22,000 lb (10,000 kg)
Armament	Internal twin barrel 23mm cannon Four wing hardpoints can carry up to 3,300 lb (1,500 kg) of ordnance

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1st Flight: 1950

Key Points: **Douglas A2D Skyshark** (**Original**) was **an prototype turboprop-powered attack aircraft designed to operate from *Casablanca*-class escort carriers**. Developed from the A-1 Skyraider, the new Allison XT-40-A2 engine developed 5,100 shaft horsepower (more than double the horsepower of the Skyraider's R-3350). Contra-rotating propellers were needed to harness all the available power. 2 prototype and 10 pre-production A2D's were built. Delays with the XT40 engine and **mothballing of the Casablanca carriers resulted in the cancellation of the Skyshark program** in 1954.

This: BuNo. 125485, is the sole survivor of the A2D's. It was restored for static display by Pacific Fighters, Idaho Falls, Idaho. Displayed Gillespie July, 2014.

Back to TOC

Douglas A2D Skyshark

Crew: 1
Length: 41 ft 2 in
Wingspan: 50 ft 0 in
Height: 17 ft 0.75 in
Empty weight: 12,944 lb (5,871 kg)
Gross weight: 18,720 lb (8,491 kg)
Max takeoff weight: 22,966 lb (10,417 kg)
Fuel capacity: 500 US gal
Powerplant: Allison XT40-A-2 turboprop, 5,100 shp
Propellers: 6-bladed, 14 ft contra-rotating constant-speed fully-feathering reversible-pitch propeller
Maximum speed: 492 mph at 40,000 ft
Cruise speed: 276 mph
Combat range: 512 mi
Ferry range: 2,200 mi
Service ceiling: 48,300 ft
Rate of climb: 7,960 ft/min
Take-off field distance sea level hot: 465 ft
Guns: 4 × 20 mm T31 cannon
Hardpoints: 13 with a capacity of 5,500 lb

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Flight Line

1st Flight: 1945

Key Points: **Lockheed P-2 Neptune** (**Original**)(designated **P2V** by Navy prior to September 1962) was **Navy's primary maritime patrol and anti-submarine warfare (ASW) aircraft**. A land-based aircraft, **it was the "hunter" in the Navy's "Hunter-Killer Group",** aided with Sonobuoys, twin .50 caliber machine guns in the nose, AN/ASQ-8 Magnetic Anomaly Detector and a belly-mounted AN/APS-20 surface-search radar enabled detection of surfaced and snorkeling submarines at considerable distances. **Modified for use in covert ops, Vietnam war, Falklands war and civilian fire fighting**. **Over 1100 build** until retired in 1978.

This: Operated by Neptune Aviation Services as a civilian fire fighter until flown to Gillespie and donated to SDASM in Feb, 2019.

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Lockheed P-2 Neptune

Crew: 7–9
Empty weight: 49,935 lb
Max. takeoff weight: 79,895 lb
Power plant:
2 × Westinghouse J34-WE-34 turbojet, 3,400 lbf each
2 × Wright R-3350-32W Cyclone Turbo-compound radial engine, 3,700 hp
Maximum speed: 316 kn (all engines)
Cruise speed: 180 kn (max)
Range: 1,912 nmi (2,157 mi)
Service ceiling: 22,400 ft
Rockets: 2.75 in FFAR in removable wing-mounted pods
Bombs: 8,000 lb including free-fall bombs, depth charges, and torpedoes

Extra Info: The third production **P2V-1** was chosen for a record-setting unrefueled long distance record. Loaded with fuel in extra tanks, "**The Truculent Turtle**" set out from Perth, Australia to the United States. With a crew of four (and a nine-month-old gray kangaroo, a gift from Australia for the National Zoo in Washington, D.C.) the aircraft set off on 9 September 1946, with a RATO (rocket-assisted takeoff). **2 1/2 days (55h, 18m) later, "The Turtle" touched down in Columbus, Ohio, 11,236.6 miles from its starting point. It was the longest un-refueled flight made to that point.**

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Flight Line

1st Flight: 1975

Key Points: **Rutan VariEze Kit Aircraft** (**Original**) is a composite, **canard aircraft** designed by Burt Rutan. A high-performance homebuilt aircraft, **over 400 have been constructed**. VariEze is notable for popularizing the canard configuration and mold-less composite construction for homebuilt aircraft.

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Key Points: **Rutan VariEze Kit Aircraft**

General characteristics

Crew: 1
Capacity: 1 passenger
Length: 14 ft 2 in
Wingspan: 22 ft 2.5 in
Empty weight: 580 lb
Max takeoff weight: 1,050 lb
Fuel capacity: 24 US Gal
Powerplant: 1 × Continental O-200-B air-cooled flat-four engine, 100 hp

Performance

Maximum speed: 195 mph
Cruise speed: 165 mph
Stall speed: 55.5 mph
Range: 850 mi at econ cruise
Rate of climb: 1,600 ft/min

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Hangar 1

Key Points: Hangar 1 was purchased in **1984**, with a grant from the Parker Foundation and is dedicated to Kenneth R. Rearwin (Past Director of the SDASM).

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Hangar 1

This building was made possible, in part, by a generous grant from
THE PARKER FOUNDATION
(Gerald and Inez Grant Parker)
The building is dedicated, in part to
Kenneth R. Rearwin
President Emeritus of the Parker Foundation and devoted and capable Director of the
San Diego Aerospace Museum
Dedicated October, 1997

In **1984**, the **San Diego Air & Space Museum moved into its 10,000 square foot hangar at Gillespie Field** in El Cajon. This storage and restoration facility is located at the north eastern corner of the airport and visitors can view various aircraft in the SDASM collection. Numerous examples of large military jets, private sport aircraft and small racing planes are stored and displayed here.

The restoration shops at Gillespie, like those in the basement of the main museum building, are staffed by highly skilled volunteers. In addition to repairing various historic aircraft, they are **able to build planes from scratch**, which they did with the splendid Sopwith Pup on display in the World War I Gallery.

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Model Shop

Key Points: **SDASM's renowned Model Shop.** North wall, Hangar 1.

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Hangar 1

Key Points: The Model Shop **builds, repairs and maintains the numerous large aircraft models on display at Balboa Park and Gillespie**. The shop is staffed with highly skilled volunteer craftsman. Currently working on a **Douglas C-47 Skytrain** model to be displayed towing the Waco CG-4 Glider hanging in the WWII Gallery at Balboa Park.

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Hangar 1

Key Points: Seen hanging from the ceiling are examples of the Model Shops handy work. The shop also built the **B-24 Liberator Bomber** (1/4 Scale) and the magnificent **B-17 Flying Fortress** models on display in the WWII Gallery at Balboa Park.

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First Flight: 1976

Key Points: **General Dynamics Tomahawk** (**Original**) **Cruise missiles** are pilotless, flight vehicles designed to strike and destroy enemy targets on the ground. The first practical cruise missile used in combat was the **German V-1 in WWII**. The second was the U.S. **Tomahawk used in the First Gulf War** in 1991. The Tomahawk was designed along the lines of the German V-1. The Tomahawk was the fruit of the Convair Division of General Dynamics in 1976 when they built the BGM-109 Tomahawk submarine launched cruise missile. The turbofan engine was designed by the Williams Research Company and McDonnell Douglas designed the guidance system.

This: Gifted to the Museum in 1999 by the Raytheon Systems Company. It is an inert missile and was received in several parts, and was assembled by Museum volunteers. Several of the volunteers assisting in the assembly and refurbishing effort had participated in the early years of Tomahawk production.

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General Dynamics Tomahawk

TECHNICAL DATA	
MANUFACTURER:	General Dynamics (initially), Raytheon/McDonnell Douglas
POWERPLANT:	Williams International F107-WR-402 Cruise Turbofan
SPAN:	8.75 ft
LENGTH:	18 ft 3 in (20 ft 6 in with booster)
DIAMETER:	20.4 in
WEIGHT:	Empty 2,900 lbs (3,500 lbs with booster)
MAX SPEED:	550 mph

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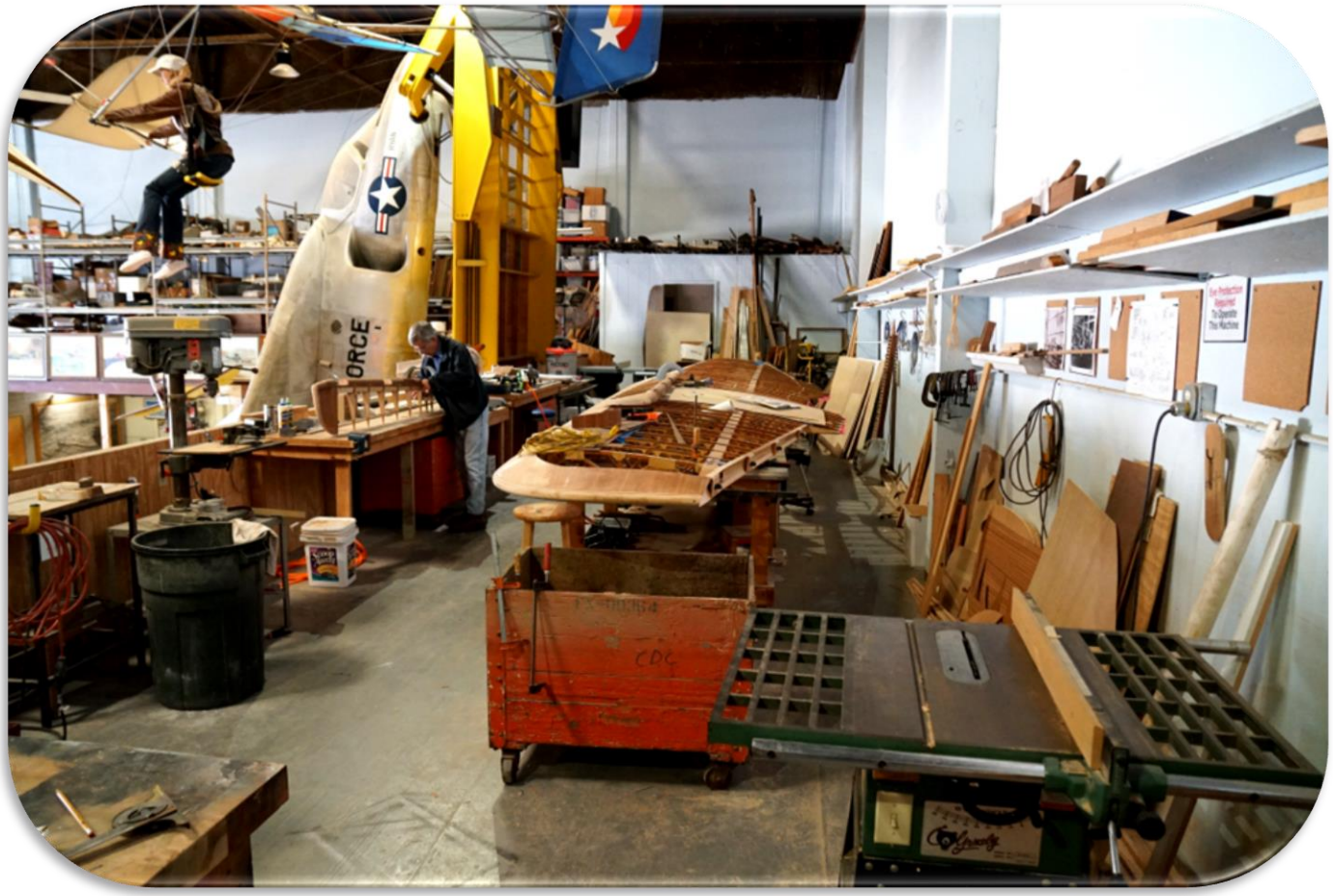
Upholstery Shop

Upstairs:
Known as the
“Loft”

Back to TOC

Hangar 1



Key Points: **Upholstery Shop - Fabrication and Repair Work Area**, Hangar 1 Loft, the largest of the three areas for wood and fabric layout, cleaning, repair or construction of aircraft artifacts, assemblies or components. Showing wood stock, supplies, tools, layout tables and in-progress restoration of early wooden wing.

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Hangar 1

Key Points: **Upholstery Shop - Fabrication and Repair Work Area**, Hangar 1 Loft, one of three areas for wood and fabric layout, cleaning, repair or construction of aircraft artifacts, assemblies or components. Showing storeroom, wood stock, supplies, tools and layout tables.

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Hangar 1

Key Points: **Upholstery Shop - Fabrication and Repair Work Area**, Hangar 1 Loft, one of three areas for wood and fabric layout, cleaning, repair or construction of aircraft artifacts, assemblies or components. Shown with large layout tables and multiple 'in-progress' projects.

Back to TOC

First Run: 1941

Key Points: **Willys MB "Jeep"** (**Original** Willys - Army Air Force version) In the early 1930's the U. S. Army was interested in acquiring a light, maneuverable, four-wheel drive, off road vehicle for reconnaissance and other duties. American Bantum, Willys Overland, and Ford Motor built test vehicles vying for the contract. Willys won due to its more powerful 60 HP engine, lower cost & silhouette. Design features in the Bantam and Ford entries were incorporated into the Willys car, moving it from a "Military A" designation to "Military B", thus the "MB" nomenclature.

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Extra Info: **Willys MB "Jeep"** (**Original** Willys - Navy version) Popular theories on the origin of the **Jeep** name say it comes from an acronym for "General Purpose:" GP. Others point to Eugene the **Jeep**, a character from the Popeye comic strip. What ever the source, the **"Jeep"** entered mass production and introduced several new automotive technologies. Having four-wheel drive on a regular car sized production vehicle for the first time introduced the need for a transfer case, and the use of constant-velocity joints on the driven front wheels and axle. By the end of the war Willys had produced about **363,000 Jeeps and Ford about 280,000**. After the war they went into the civilian market."

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First Flight: 1958

Key Points: **Adams-Wilson Hobbycopter XH-1.** (**Original**) Built in 1957 by TG Adams and Paul Wilson (Later Adams-Wilson Helicopters Inc) in Lakewood , CA. Known as the **Flying Triumph**, it was **designed to use commonly found materials that were readily available to customers**. The Adams-Wilson XH-1 N93P was the **first lightweight single-seat helicopter prototype designed for amateur construction** from Adams-Wilson Helicopters. The Hobbycopter inspired many ultralight helicopter achievements since, all more or less comparable to the XH-1.

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Extra Info: The anti-torque rotor was made of forged aluminum, driven by a belt, while the wooden main rotor blades were driven by a shaft from a gearbox. The engine used was a **34 hp Triumph 650 cc motorcycle engine** (later engines included a snowmobile motor and an ultralight 2-cycle Rotax 503 engine developing 52 hp), topped with an 3 gallon fuel tank. Further developments included a fibre-glass cockpit enclosure and driveshaft for the tail rotor.

Technical characteristics: Diameter of the main rotor: 21 ft; Diameter of the tail rotor: 3 ft; Length of the fuselage: 14 ft; Overall height: 6 ft; Empty weight: 355 lb; Maximum weight: 555 lb; 34 hp Triumph engine; Maximum speed: 85 mph; Maximum cruising speed: 60 mph; Economic cruising speed: 50 mph; Ceiling: 8000 ft.

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First Flight: 1911

Key Points: **Wright EX Vin Fiz** (Reproduction) **Completed first flight across U.S. trying to win Hearst $50K prize for first flight crossing U.S. in less than 30 days.** Piloted by Calbraith Rodgers, sponsored by Armour Co. to advertise their grape soda "Vin Fiz." Powered by a **35-horsepower, Wright inline 4 cylinder engine**, and it carried enough fuel for a maximum of 3½ hours flying time. Performance: Max speed 55 mph, cruise speed 51 mph, range 190 miles.

This: The Museum's reproduction Vin Fiz is the product of legendary aviation author Peter Bowers. It was built in 1961 to commemorate the 50th anniversary of the first transcontinental flight. The airplane is built to air-worthy standards and has been flown as a towed glider.

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TECHNICAL DATA

MANUFACTURER:	Wright Brothers, Dayton, Ohio
POWERPLANT:	One 35 hp, 4 cylinder, liquid-cooled Wright inline
SPAN:	31 ft 7 in
LENGTH:	21 ft 5 in
HEIGHT:	7 ft 4 in
MAX SPEED:	55 mph
YEAR BUILT:	Original, 1911; Reproduction, 1961

On temporary display at Balboa Park

Extra Info: Special railroad car outfitted to support the trip. **75 stops along the way of which at least a dozen were crashes…Rodgers was injured several times**. Only a few pieces of the original plane made the entire trip. **After flying approximately 4,300 miles, taking 84 flight hours and over 49 days, Rodgers landed his plane on the beach at Long Beach, CA. On April 3, 1912, while flying over Long Beach, he flew into a flock of birds, causing the plane he was flying to crash into the ocean and he died. What remains of the original Vin Fiz is held by the Smithsonian.**

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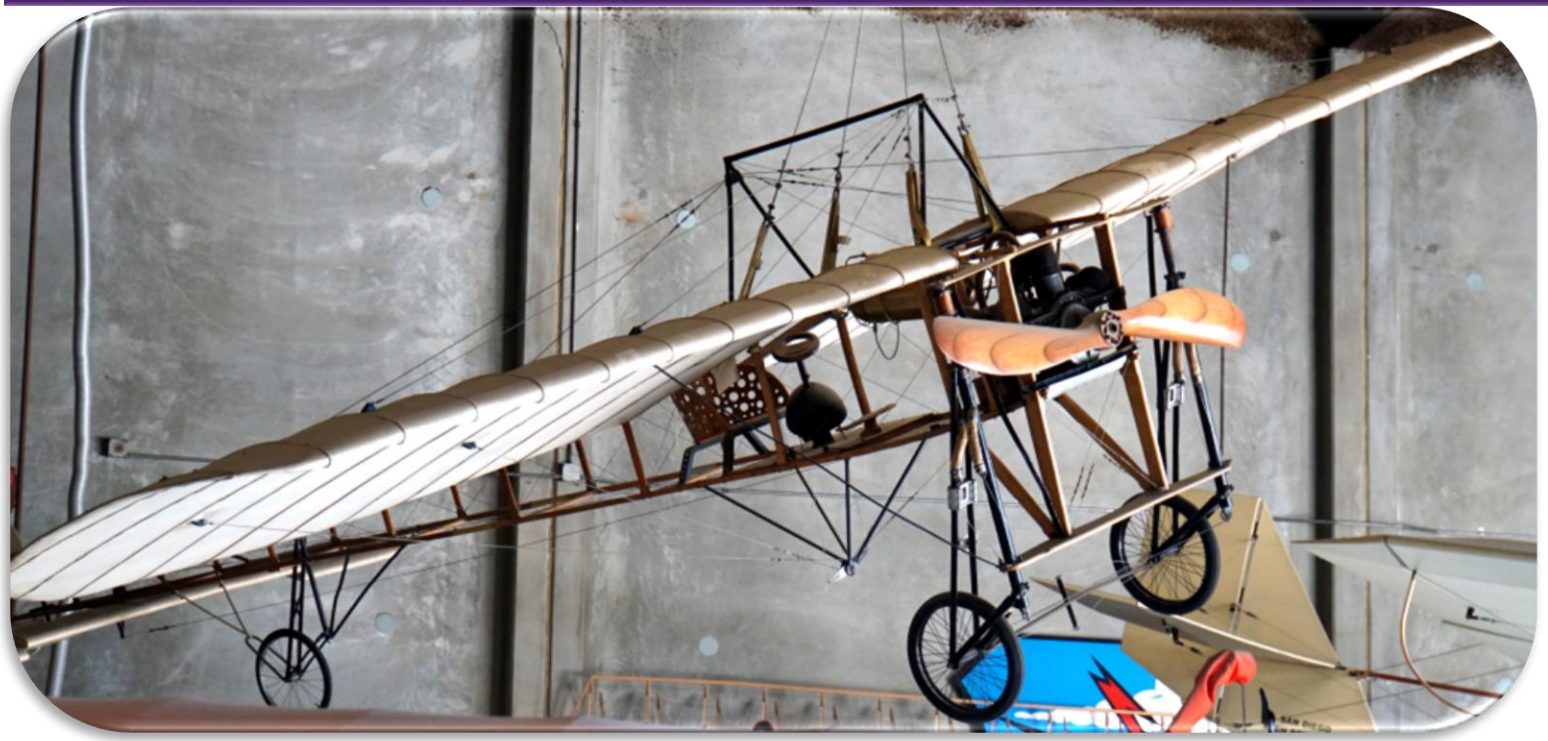

1st flight: 1908

Key Points: **Bleriot XI** (Original Parts) **Won Lord Northcliffe £1000 prize, first airplane across the English Channel, July 25, 1909**. Covered **23 miles in 36 ½ minutes**. Used Wright's method of wing warping, rudder & elevator controls. One of the most important airplanes of the era. **1909 to 1914, over 800 Bleriot's were produced**. **Influenced** the famous **Deperdussin** & German Fokker **Eindecker**. Powered by **Anzani 3-cyl air-cooled radial piston engine, 25 hp. Max speed: 47 mph.** Weighed 720 lbs.

This: One of two Bleriot XIs rebuilt by John Russell Frapwell from a collection of original Bleriot parts. One was donated to the RAF Benevolent Fund and later sold to the San Diego Air and Space Museum in 1990.

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Frenchman Louis Bleriot began manufacturing airplanes near Paris in 1905. Though his first company tailed after only one year, Bleriot persevered, experimenting with aircraft designs of various configurations, including his 1907 Bleriot V, the world's first practical monoplane.

In October 1908, London's Daily Mail newspaper announced a £1000-prize to the first pilot to fly across the English Channel. Though his aircraft had never run for more than twenty minutes - about half of the Channel's 22-mile distance - Bleriot jumped at the chance. His new Bleriot XI, which he unveiled on Christmas Eve 1908, featured a new engine from Italian Alessandro Anzani. The Anzani had one key virtue: it could run continuously for an hour.

Specifications

MANUFACTURER	Bleriot
TYPE	Single-seat civil aircraft
ENGINE	One Azani three-cylinder; 25-horsepower; air-cooled
HEIGHT	7ft 9 in (2.3 m)
GROSS WEIGHT	772 lbs (349.9 kg)
MAXIMUM SPEED	47 mph (75.6 km/h)
RANGE	22 miles (35.4 km)
CEILING	200ft (61 m)
CREW	1

On July 25, 1909, Bleriot took off from the French coast near Calais and headed across the English Channel, landing in England 37 minutes later. While Bleriot's feat delighted the French, it worried the English, who realized they had suddenly become vulnerable to air attack. Sir Alan Cobham wrote, "The day Bleriot flew the Channel marked the end of our insular safety, and the beginning of the time when Britain must seek another form of defense besides ships."

The Bleriot XI design was not lost on America, where an enterprising manufacturer, the Queen Aeroplane Co. of New York, began building and selling it in 1910. The Bleriot XI continued making news, winning three of Europe's major long-distance air races in 1911. Over 800 were produced between 1909 and 1914, making it the first commercially successful monoplane.

Bleriot XI

Back to TOC

Hangar 1

1st flight: 1929

Key Points: **San Diego High School 1929 Glider.**

This: This San Diego HS glider is reproduction of one built at the high school in 1929. Built by SDASM volunteers at Gillespie.

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Hangar 1

1st flight: 1891

Key Points: **Lilienthal Glider** (Reproduction). German engineer **Otto Lilienthal** (1848 – 1896) studied aerodynamics then built a glider that would fly and be controlled. He made his flights from an artificial hill he built near Berlin and from natural hills in the area, so he could always take of into the wind. Wrote the book ***Birdflight as the Basis of Aviation*** in 1889. This **text was used by the Wright brothers**, however, they abandoned his aeronautical data after two seasons of gliding and began using their own wind tunnel data. **Lilienthal was considered the first pilot because he could control (fly) the glider by shifting his body weight.** Over **2,000 flights** between 1891 and his death in a crash in 1896.

This: Modeled after glider #11 from 1896, built by John Lichtenburg, from Lilienthal's original drawings, weighed 40 lbs. This glider was completed in 1978.

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Hangar 1

1st flight: 1984

Key Points: **Braden Denver Kitfox III** (**Original**) A series of side-by-side, **two-seat, high-wing, single engine kit aircraft**, designed and originally manufactured by Dan Denney and his company Denney Aerocraft of Boise, Idaho. The aircraft is amateur-built and **over 4500 kits have been delivered in 42 different countries**. The Kitfox was an early kit plane to feature quickly-folding wings for carriage and storage. It could be built in a two-car garage and be towed to the airport with wings folded. The landing gear easily converted to floats or skis.

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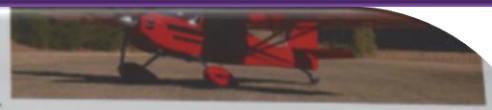
Hangar 1

SAN DIEGO AIR&SPACE MUSEUM



The Kitfox is unique in that it was one of the first designs to make popular a quickly folding wing that greatly eased transportation and storage. The aircraft is amateur-built and not type certified and was originally designed to accommodate a Rotax engine.

The large appeal of the aircraft was in large part due to the fact it could be built by any handyman in a two car garage and then towed to the airport with the wings folded. The design allowed for easy conversion to floats or skis. Over 4500 kits have been delivered in 42 different countries.

The Denney Kitfox is a series of small personal kit aircraft with folding wings that was originally designed and manufactured by Dan Denney and his company Denney Aerocraft of Boise, Idaho.

1-STEM "Discovery" at the SDASM Annex

Kitfox General characteristics

Crew: one
Capacity: one passenger
Length: 18 ft 5 in (5.6 m)
Wingspan: 32 ft (9.76 m)
Height: 5 ft 8 in (tailwheel) (1.73 m)
Wing area: 132 ft² (12.28 m²)
Empty weight: 650 lb (295 kg)
Loaded weight: 1200 lb (544 kg)
Useful load: 550 lbs (250 kg)
Powerplant: 1 × Rotax 912, 80 hp (60 kW)
Propellers: 1 propeller

Performance

Never exceed speed: 125 mph (203 km/h)
Maximum speed: 117 mph (190 km/h)
Cruise speed: 110 mph (178 km/h)
Stall speed: 37 mph (60 km/h)
Range: 785 miles (1272 km)
Rate of climb: 1200 fpm (6.1 m/s)
Wing loading: 9.09 lb/ft² (44.3 kg/m²)
Power/mass: 15 lb/hp (0.11 kW/kg)

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Hangar 1

1st flight: 1916

Key Points: **Sopwith Pup** (Reproduction) was a British **single-seater biplane fighter aircraft** built by the Sopwith Aviation Company. It was the **first British aircraft to carry a machine gun synchronized to fire through the propeller**. It entered service with the Royal Flying Corps and the Royal Naval Air Service in the autumn of 1916.

This: SDASM staff constructed this reproduction at the Gillespie Field annex. Completion was in 2005, when the airframe was placed on prominent display in the Gildred Rotunda of the main museum. It is shown "cutaway", without the canvas fitted, to show the intricate structure of the airframe.

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Hangar 1

Extra Info: With **great flying characteristics and good maneuverability**, the Pup proved very successful. The Pup was eventually outclassed by newer German fighters, but it was not completely replaced on the Western Front until the end of 1917.
After the war, the remaining Sopwith Pups were relegated to Home Defense and training units. The Pup's flying characteristics also made it ideal for use in aircraft carrier deck landing and takeoff experiments.
Specifications: Engine: **80 hp LeRhone Rotary 9-cyl**. Weight: 787 lbs (empty) 1225 lbs (gross). **Max. Speed: 111.5 mph** at sea level, 105 mph at 5,000 ft. Ceiling: 17,500 ft. Armament: One Vickers .303 mg (synchronized). **Approximately 1770 were built**.

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Hangar 1

1st flight: 1939

Key Points: **Rearwin Cloudster, Model 8135** (**Original**) **Known for their superb flying characteristics, spacious accommodations, and economy**, the Cloudster way based on the successfull Rearwin Sportster, a two-place tandem seated airplane. Rae Rearwin was reluctant to produce a side-by-side airplane because of the extra drag involved. However, Ken Rearwin convinced him that side-byside was replacing tandem-seating and Rae agreed to the new design. The first Cloudster was finished in time for the 1939 Cleveland Air Races and was flown there by Ken Rearwin. It was a larger and more powerful derivative of the Rearwin Sportster with the 8090 and 8125 models having side-by-side seating instead of the Sportster's tandem seating. The **8135 Cloudster had three seats.** Twenty examples were produced with tandem seating for Pan Am to use as trainers, and another 25 Cloudsters were exported as trainers to Iran.

This: The Museum's Cloudster model 8135 is on display at Gillespie Field. It was donated by Kenneth R. Rearwin of La Jolla, CA, in 1979.

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Key Points: **Rearwin Cloudster, Model 8135**

TECHNICAL DATA
Manufacturer : Rearwin Airplanes, Kansas City, Kansas
Occupants: 3
Powerplant: **One Ken-Royce 7G** (F?), **125 hp** (120?)
Span : 34 ft 2 in
Length: 21 ft 6 in
Height: 7 ft 4 in
Weight: Empty 1,140 lbs (1130?)
Weight: Gross 1,900 lbs (1800?)
Max speed: 135 mph (140?)
Cruise speed: 125 mph
fuel consumotion: 7 gph
Year built: Original, 1939
Serial number: 829

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1st flight: 1971

Key Points: **N21PC Ms Mombo** A **Monnett Sonerai II** (Original) is a small, **VW-powered homebuilt aircraft**, designed by John Monnett. The Sonerai began to compete as a single seat mid-wing Formula-V racer class formed in 1972. The Sonerai soon evolved into a two-seat model called the Sonerai II.

This: ?

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Monnett Sonerai II

General characteristics

Crew: 1
Length: 18 ft 10 in
Wingspan: 18 ft 8 in
Empty weight: 520 lb
Max takeoff weight: 950 lb
Powerplant: 1700cc Volkswagen air-cooled engine

Performance

Maximum speed: 170 kn (200 mph)
Cruise speed: 120 kn (140 mph)
Stall speed: 39 kn (45 mph)
Range: 213 nmi (245 mi)
Rate of climb: 500 ft/min

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1st flight:
1926 (SM-1)

Key Points: Stinson SM-8A Junior (**Original**) Eddie Stinson developed the SM "Detroiter" line during the depression. **First American aircraft to combine an enclosed and heated cabin, an engine starter, and wheel brakes on one airplane**.

It became famous for its load-carrying ability, speed, and range. **Detroiters set records for endurance and efficiency.** Refueling endurance record, July 1929, of 174 hours, 59 seconds and distance record of 12295 miles. **Over 230 SM-8's built**.

This: Our Stinson Junior, an SM-8A was built in 1930 and flown regularly until 2005 when it was flown in to Gillespie Field by International Aerospace Hall of Fame member Si Robin who donated it to the Museum.

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Extra Info: **In 1929 automobile mogul E.L. Cord purchased 60% of Stinson Stock; later Stinson spun off to AVCO and ultimately Consolidated Vultee Aircraft through WWII**. In 1950, Piper Aircraft purchased the Stinson name and all the company assets turning out Stinson airplanes alongside the well-known Piper Pacer and Tri-Pacer. **One Stinson design, the Twin Stinson, was brought to production by Piper as the Apache, the world's first all metal general aviation light twin aircraft.**

TECHNICAL DATA

MANUFACTURER:	Stinson Aircraft Company
POWERPLANT:	Lycoming R-680, one radial engine, 210 hp
SPAN:	41 ft 7 in
LENGTH:	28 ft 9 in
HEIGHT:	8 ft 8 in
WEIGHT:	Empty 2,250 lbs (gross, 3,195 lbs)
YEAR BUILT:	Original, 1930

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1st flight: 1955

Key Points: **Ryan X-13 Vertijet Jet** (**Original**) **In 1947, Navy awarded a contract to Ryan for a pure-jet vertical take-off and landing aircraft (VTOL).** After nearly seven years of technical study and experimentation, the now Air Force contract was won for two VTOL aircraft to be designated X-13. The first aircraft was completed in 1955 and flown by Peter Girard at Edwards Air Force Base. April 11, 1957, the first full cycle of vertical take-off, rotation to horizontal flight, return to vertical flight, and landing was completed proving the VTOL technology. Program ended in 1958.

This: **Number 41619 was the first X-13 built**. On loan from the National Air and Space Museum, Washington, D.C.

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Hangar 1

RYAN X-13

On July 30, 1957, the X-13 was demonstrated by test pilot Peter F. Girard to a crowd of some 100,000 people in front of the Pentagon in Washington, D.C. This unique aircraft took off vertically from its launching platform, rotated to horizontal flight, and flew the same course as the Wright military aircraft on its acceptance flight exactly 48 years earlier. The X-13 then returned to vertical flight and landed — all within a seven-minute period!

The X-13 program was completed in the fall of 1958. This unique plane had proven that VTOL flight, on jet thrust alone, was both feasible and practical. The success of the X-13's test program was indeed historic. It led the way for other VTOL aircraft developments such as the Harrier vertical and short take-off and landing aircraft (V/STOL). Both the U.S. Marines and the British currently use Harrier aircraft.

The San Diego Aerospace Museum's X-13 is on loan from the National Air and Space Museum, Washington, D.C. The only other X-13 is in storage at the Air Force Museum in Dayton, Ohio.

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Hangar 1

1st flight: 1977

Key Points: **1985 Christen Eagle II** (**Original**) an **aerobatic sporting biplane** built by Christen Industries, Salt Lake City, UT. **Designed to compete with Pitts Special**. The Eagle II is available in kit form for homebuilding. It's single-bay, equal-span staggered biplane wings braced with streamlined wires and an I-strut to form a box truss. **Pilot and single passenger sit in tandem** under large bubble canopy. Tailwheel is fixed, mainwheels mounted on spring aluminum legs and in streamlined fairings. Fuselage, tail constructed of chromoly welded tube, forward fuselage skinned in aluminum, rear fuselage and tail covered in fabric. Wing structure is spruce and fabric covered. The engine cowling is fiberglass. **Over 350 aircraft flying.**

This: Built in 1985 by Kenneth Kraska.

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Christen Eagle II

General characteristics

- **Crew:** Two
- **Length:** 17 ft 11 in
- **Wingspan:** 19 ft 11 in
- **Height:** 6 ft 6 in
- **Empty weight:** 1,025 lb
- **Max takeoff weight:** 1,578 lb
- **Fuel capacity:** 24 US gal, usable
- **Powerplant:** Textron Lycoming AEIO-360-A1D air-cooled flat-four, 200 hp
- **Propeller:** 2-bladed Hartzell constant-speed propeller, 6 ft 4 in diameter

Performance

- **Maximum speed:** 184 mph (160 kn)
- **Cruise speed:** 165 mph (143 kn)
- **Stall speed:** 58 mph (50 kn)
- **Never exceed speed:** 210 mph (180 kn)
- **Range:** 437 mi (380 nmi)
- **Service ceiling:** 17,000 ft
- **G limits:** +9, -6
- **Rate of climb:** 2,100 ft/min (11 m/s)

Back to TOC

Hangar 1

1st flight: 1941

Key Points:

Ryan ST3KR PT-22 Recruit (**Original**). This **"Primary Trainer"** was the Army Air Corp's **first purpose built monoplane trainer, over 1000 built**. Trained 14,000+ pilots. 160 hp 5 cylinder Kinner R-56 radial. Reputed to be a 'challenge' to fly, it was capable of just about anything a pilot was willing to try, but it demanded the pilots full attention. On Mar 5, 2015, actor Harrison Ford crash landed his PT-22 at a Los Angeles golf course after reporting an engine failure. Ford receiver minor injuries to his head and a broken arm.

This - Built in 1941, Ryan Aeronautical of San Diego, California; based at Sequoia Field in Visalia, CA throughout WW2. Continuous FAA license from 1945 to 1982. Restored by Fred C. Ellsworth of Kent, Washington, who donated it to the Museum in 1982.

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RYAN ST-3KR (PT-22) RECRUIT

The Ryan model ST-3KR, US Army Air Corps PT-22, evolved from the popular Ryan STA "Sport Trainer" and incorporated refinements to the design that resulted in a rugged and easily maintained military trainer. The in-line Menaco engine of the STA was replaced with a more powerful and dependable Kinner radial, the fuselage was widened and elongated for ease of access and friendlier flying characteristics, and the wheel spats, along with other fairings were removed to simplify the aircraft. 1,019 PT-22's were produced in 1941 and 1942.

Ryan training schools located at Lindbergh Field in San Diego, Hemet, California, and Tucson, Arizona, under contract with the US government trained thousands of pilots during World War II. At its peak, in the fall of 1943, Ryan was training more than 1200 cadets at a time—most in the PT-22.

ABOUT THE MUSEUM'S AIRCRAFT

Built in 1941, serial number 41-20692 was based at Sequoia Field in Visalia, California throughout the war. It is in like new flyable condition. It was donated to the museum in 1982 by Fred C. Ellsworth. Of note, the aircraft was owned until 1967 by Don D. Lindbergh.

SPECIFICATIONS

MANUFACTURER	Ryan Aeronautical, San Diego, California
TYPE	Two-seat military primary trainer
ENGINE	Kinner R-56
WINGSPAN	30ft 1in (9.17m)
LENGTH	22ft 7 1/2in (6.9m)
HEIGHT	7ft 2in (2.18m)
GROSS WEIGHT	1,860 lbs (843.68kg)
CRUISE SPEED	100 mph (160.93Km/hr)
RANGE	352 miles (566.5Km)
CEILING	15,500 ft (4,724.4m)
ARMAMENT	None
CREW	Two

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Hangar 1

1st flight: 1932

Key Points: Beechcraft D17S "Staggerwing Beech" (Original) At the height of the Great Depression, aircraft executive Walter H. Beech and airplane designer Ted A. Wells joined forces to collaborate on a project to produce a **large, powerful, and fast cabin biplane built specifically for the business executive**. The Beechcraft Model 17, popularly known as the "Staggerwing", **was used as an executive aircraft, much as the private jet is now**, and its primary competition were the Waco Custom Cabin and Waco Standard Cabin series of biplanes. **785 built**.

This: Owned and donated to SDASM by William Barron Hilton in 2019.

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General characteristics

Crew: one,
Capacity: three passengers
Payload: 125 lb of baggage
Length: 26 ft 10 in
Wingspan: 32 ft
Height: 8 ft
Empty weight: 2,540 lb
Loaded weight: 4,250 lb
Powerplant: Pratt & Whitney R-985-AN-1 "Wasp Junior" radial engine, 450 hp

Performance

Maximum speed: 212 mph (184 knots)
Cruise speed: 202 mph (176 knots)
Range: 582 nm
Service ceiling: 25,000 ft (7,600 m)
Rate of climb: 1,500 ft/min (7.6 m/s)

Extra Info: Staggerwing Beech. The Model 17's **unusual negative stagger wing configuration** (the upper wing staggered behind the lower) and unique shape **maximized pilot visibility** and was intended to reduce interference drag between the wings (although it was later found to have negligible effect). The fabric- covered fuselage was faired with wood formers and stringers over a welded, steel tube frame. Construction was complex and took many man-hours to complete. The **Staggerwing's retractable conventional landing gear, uncommon at that time**, combined with careful streamlining, light weight, and a powerful radial engine, helped it perform well.

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Hangar 1

1st flight:
Unknown

Key Points: **Early hang glider.**
This: Unknown.

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1st flight: 1967

Key Points: **1973 Glasflugel STD LIBELLE 201B** (N241FM) (**Original**) is a very popular early **composite, Standard Class, single-seat, retractable gear, sailplane** produced by Glasflugel from 1967. Length: 20 ft 4 in, Wingspan: 49 ft 3 in, Height: 4 ft 1 in, Empty weight: 407 lb, Gross weight: 770 lb, Maximum speed: 160 mph. **Total of 601 built.**

This: **Donated to the Museum by Baron Hilton in 2000.**

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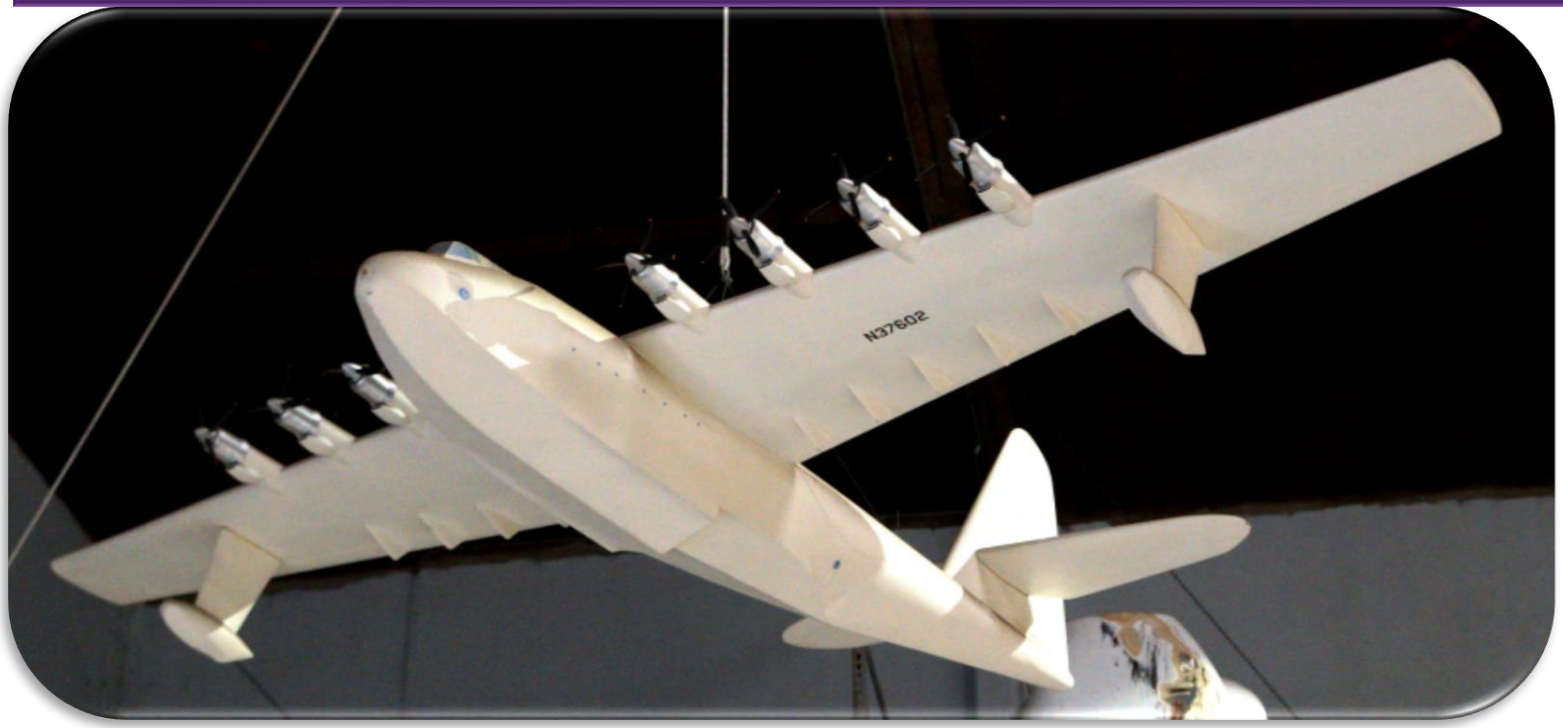
Hangar 1



1st flight: 1947 (Only Flight)

Key Points: **Hughes H-4 Hercules** (***Spruce Goose***) (Model) a **prototype strategic airlift flying boat designed and built by the Hughes Aircraft Company**. Intended as a transatlantic flight transport for use during World War II, was not completed in time for the war. Only **one brief flight on November 2, 1947, only a single example produced**. **Built from wood (wartime restrictions on aluminum) and concerns about weight, nicknamed the *Spruce Goose* by critics, although it was made almost entirely of birch. Largest flying boat ever built, largest wingspan of any aircraft that had ever flown until the Stratolaunch** flew on April 13, 2019. Original on display at the Evergreen Aviation & Space Museum in McMinnville, Oregon, United States.

This: Built by Museum volunteers in the Model Shop.

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1st flight:

Key Points: **Sukhoi-Gulfstream S-21** (Model) was a **projected Russian-American supersonic business jet.** In the early 1990s, Gulfstream Aerospace and the Sukhoi Design Bureau began a joint effort to develop a supersonic small business jet, code named the S-21. Due to questionable market demand for commercial supersonic air travel, commitment to the project weakened and delays mounted. Gulfstream eventually dissolved the partnership, although Sukhoi continued work on the S-21. The **S-21 would be capable of sustained cruise at Mach 2+** and much research and development has gone into the management of the troublesome transonic effects phenomena associated with near Mach 1 air speeds. As of 2012, the project had not received any funding for the 2013-2025 development period and appeared to be cancelled.

This: Unknown

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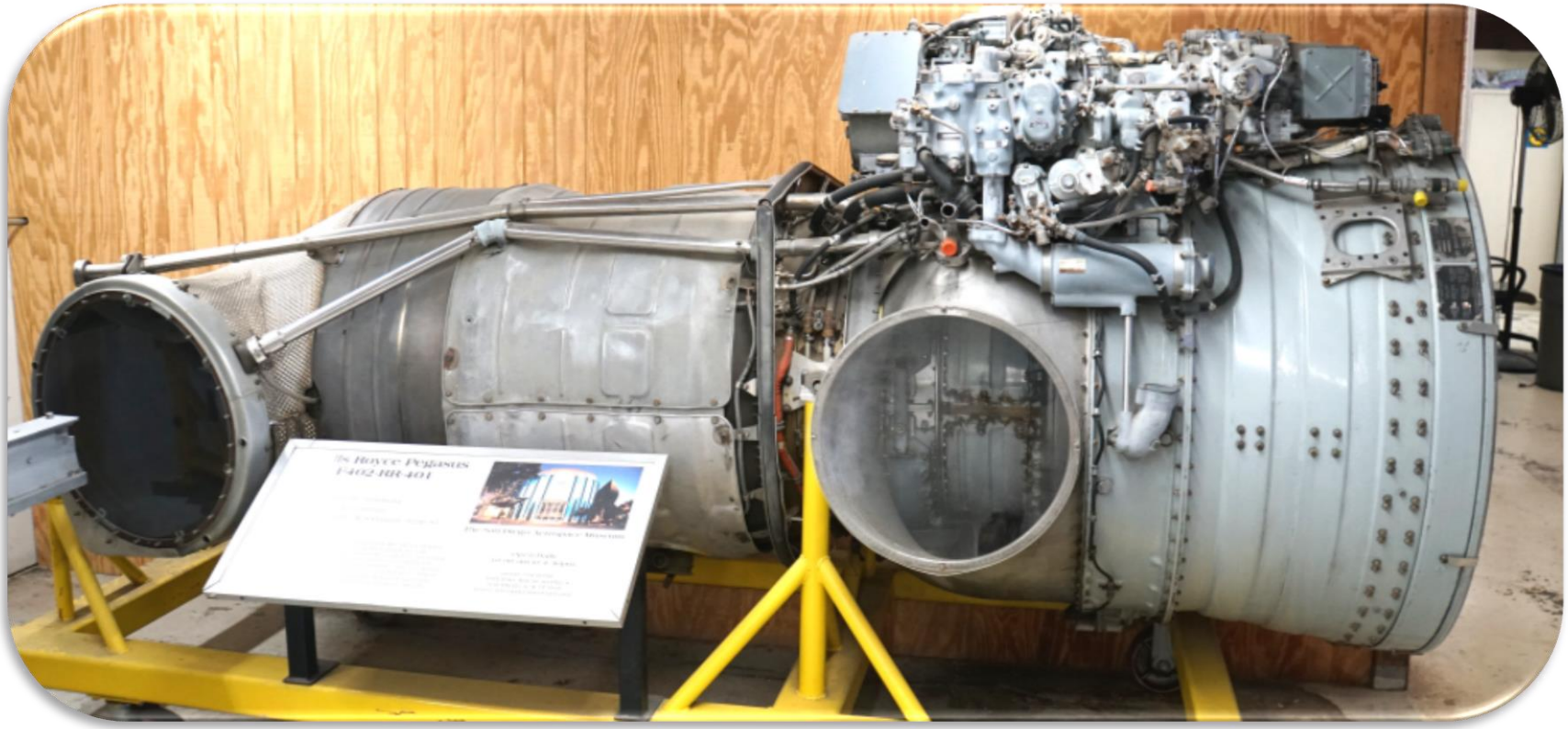
Hangar 1

Engines

Hangar 1 Engines



1st Run: 1959

Key Points: **Rolls Royce Pegasus** (**Original**) Best known as **the engine in the Hawker Siddeley Harrier.** The engine is not only able to power a jet aircraft forward, but also to direct thrust downwards via swiveling nozzles. Lightly loaded aircraft equipped with this engine can maneuver like a helicopter. In particular, they can perform vertical takeoffs and landings.

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Hangar 1 Engines

Rolls Royce Pegasus F402-RR-401

Thrust - 21,500 lbs/10,644 kg

Weight - 4,200 lbs/1909 kg

Application - USMC AV-8A Harrier "Jump Jet"

The San Diego Aerospace Museum

The Rolls-Royce Pegasus turbofan powers the AV-8A Harrier short take-off and vertical landing (STOVL) attack aircraft. The Pegasus provides propulsive thrust through four swiveling exhaust nozzles which vector engine thrust horizontally for normal flight to vertical for take-off and landing. This vectoring system eliminates the need for conventional runways. Thrust can also be vectored in flight, enabling the Harrier to perform maneuvers unmatched by most other fixed wing jet aircraft.

Open Daily
10:00 am to 4:30pm

(619) 234-8291
2001 Pan American Plaza
San Diego, CA 92101
www.aerospacemuseum.org

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Hangar 1 Engines

1st Run: 1950

Key Points: **Pratt & Whitney TF-30 (J57)** (**Original**) an axial-flow turbojet engine developed in the 1950s. The **J57 was the first 10,000 lb thrust class engine in the United States**. **21,170 were built**. Used in the **Boeing 707, B720, DC-8, B-52, C-135, KC-135, F-100, F-101, F-102, A3D, F4D, F5D, Lockheed U-2, Martin B-57, Northrop SM-62, F-8 Crusader, A-7 Corsair II, and F-14.**

This: Used in four of the Museum's aircraft. F-102 Delta Dagger, F-8 Crusader, A-7 Corsair II, and F-14 Tomcat.

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Hangar 1 Engines

PRATT & WHITNEY TF-30 TURBOFAN
MILITARY J57
1964

THIS IS THE ENGINE THAT POWERS THREE OF THE AIRCRAFT ON DISPLAY HERE AT GILLESPIE FIELD.

In 1960, the U.S. Air Force issued SOR-183 (Special Operational Requirement) for what was referred to as the future Tactical Strike Fighter, called TFX for short. Robert McNamara, then Defense Secretary, insisted that the project be combined with the FADF (Fleet Air Defense Fighter) planned by the Navy. There was no shortage of experts who said this was impossible due to the different requirements for the two projects. In spite of the objections, the politicians won out and an order was placed with General Dynamics for the F-111A for the Air Force and the F-111B for the Navy. To meet the performance requirements, a variable sweep wing was necessary. The sweep mechanism required two 100 HP hydraulic motors. The power plants were two afterburning turbofan P&W TF30-P-1s. The Navy F-111B aircraft was assembled by Grumman.

When the F-111B proved too heavy for carrier operations, Grumman was given the go-ahead to design and build the F-14 *TOMCAT*. It also incorporated the variable geometry wing and used the same engines as the F-111B. The Grumman F-14A *TOMCAT* on display on the ramp had engines of a different dash number, being P&W TF30-P-412As. The afterburners are still installed in the tail of the museum's F-14 aircraft. Grumman knew they could take the best of the F-111B and combine them with lessons learned from experienced Vietnam combat pilots, such as tandem crew seating, separating the engines as far as possible, a mix of Sparrow and Sidewinder missiles and adding an internal cannon. The result is thought to be one of the best fighters ever built.

The Vought F-8J *CRUSADER* displayed on the ramp, was powered with the J57-P-20A version of this engine. Also displayed on the ramp is the Vought A-7B *CORSAIR II* which was powered with the non-afterburning version of the engine, P&W TF-30-P-8.

SPECIFICATIONS

Ratings:	GRUMMAN	F-14A:	P&W TF30-P-412A, 12,500 lbs. static thrust, 20,900 lbs, with afterburner.
	VOUGHT	F-8J:	P&W J57-P-20A , 10,700 lbs. static thrust, 28,000 lbs. with afterburner.
	VOUGHT	A-7B:	P&W TF-30-P8, 12,200 lbs static thrust, non afterburning.

Type: High-compression, two-spool Turbofan, the first with afterburning.
Time Between Overhaul (TBO): 1,500 hours
Low Pressure Compressor: Six-stages
Combustion Chamber: Can-annular
Low Pressure Turbine: Three-stages
Weight Dry: 4,201 lbs.
Fan: Three-stages
High Pressure Compressor: Seven-stages
High Pressure Turbine: Single-stage
Fuel Grade: JP-4, JP-5 or JP-8
Dimensions: Length 235.7 inches, Diameter 50.9 inches

MANUFACTURER: THE PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION, HARTFORD, CN

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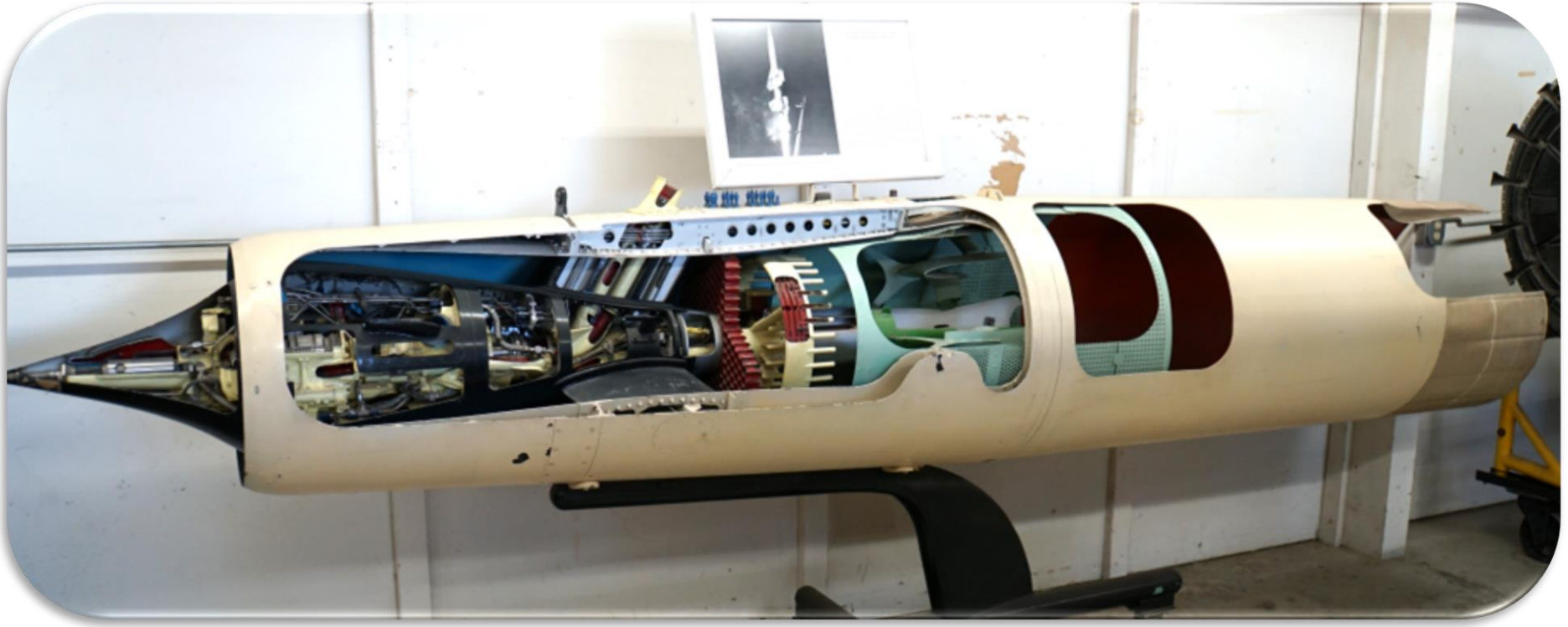

1st Run: 1950

Key Points: **Marquardt RJ43-MA-9 Ramjet Engine** (**Original**) Marquardt Corp, Ogden UT, **produced 1500 engines** from 1959-1962. Primarily used on the BOMARC Interceptor Missile, which used two ramjets, after takeoff rockets had accelerated the missile to a suitable ramjet speed. **Capable of Mach 2.7 or 1780 mph at 70,000 feet**

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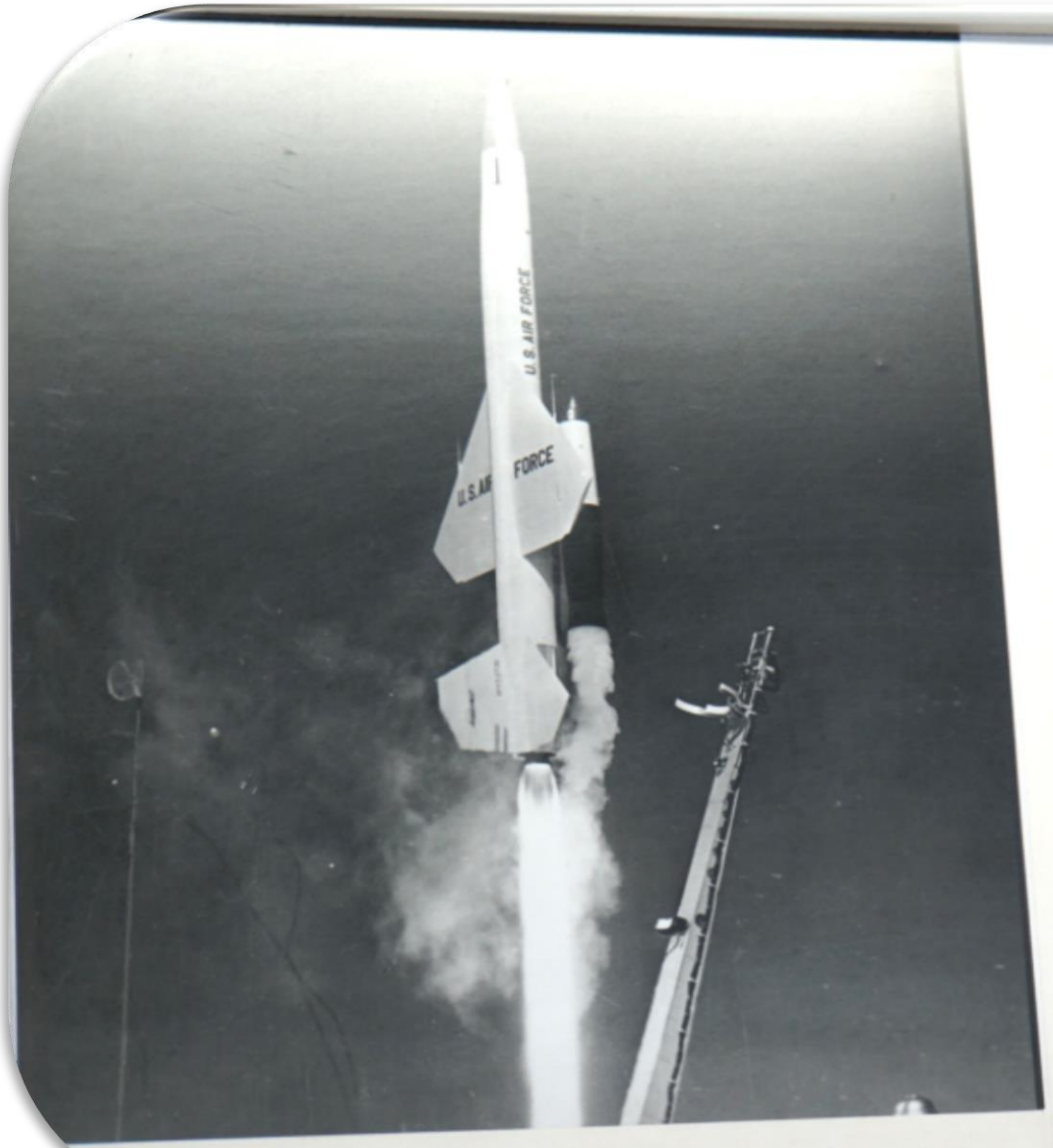
Hangar 1 Engines



launch rocket was housed in the aft end of the missile fuselage and was not jettisonable after booster cutout.

CUTAWAY RAMJET ENGINE MARQUARDT RJ43-MA-9

Marquardt Corporation at Ogden, Utah produced 1500 ramjet engines for the government between 1959 and 1962. After 328 flights with 98 percent reliability at Patrick AFB Florida the ramjets became operational. Each Boeing BOMARC Interceptor Missile mounted two powerful Marquardt Ramjets plus takeoff rockets. The BOMARC carried either high explosive or nuclear warheads to destroy enemy aircraft. When it reached a speed suitable for ramjet operation, the rockets would cut-out as the twin ramjets took over to provide supersonic acceleration and cruise flight. The ramjets were slung on struts beneath the BOMARC's slim, cylindrical fuselage. The ramjets burned JP-4 fuel and produced speeds up to Mach 2.7, or about 1,780 miles per hour at 70,000 feet.

Development flights with the Lockheed X-7 Propulsion Test Vehicle during the 1950s demonstrated maximum speeds of Mach 3.95 or about 2,700 mph and a maximum altitude of 95,000 feet with similar ramjet engines. During the 1960s production engines were modified and installed in the Lockheed D-21 Drone to provide sustainer propulsion for special high altitude supersonic long range reconnaissance missions. After becoming obsolete in the 1970s some BOMARC missiles served as target drones in the 1980s for the Navy and Air Force.

This cut-away ramjet was donated to the museum by Kaiser/Marquardt in March 1993.

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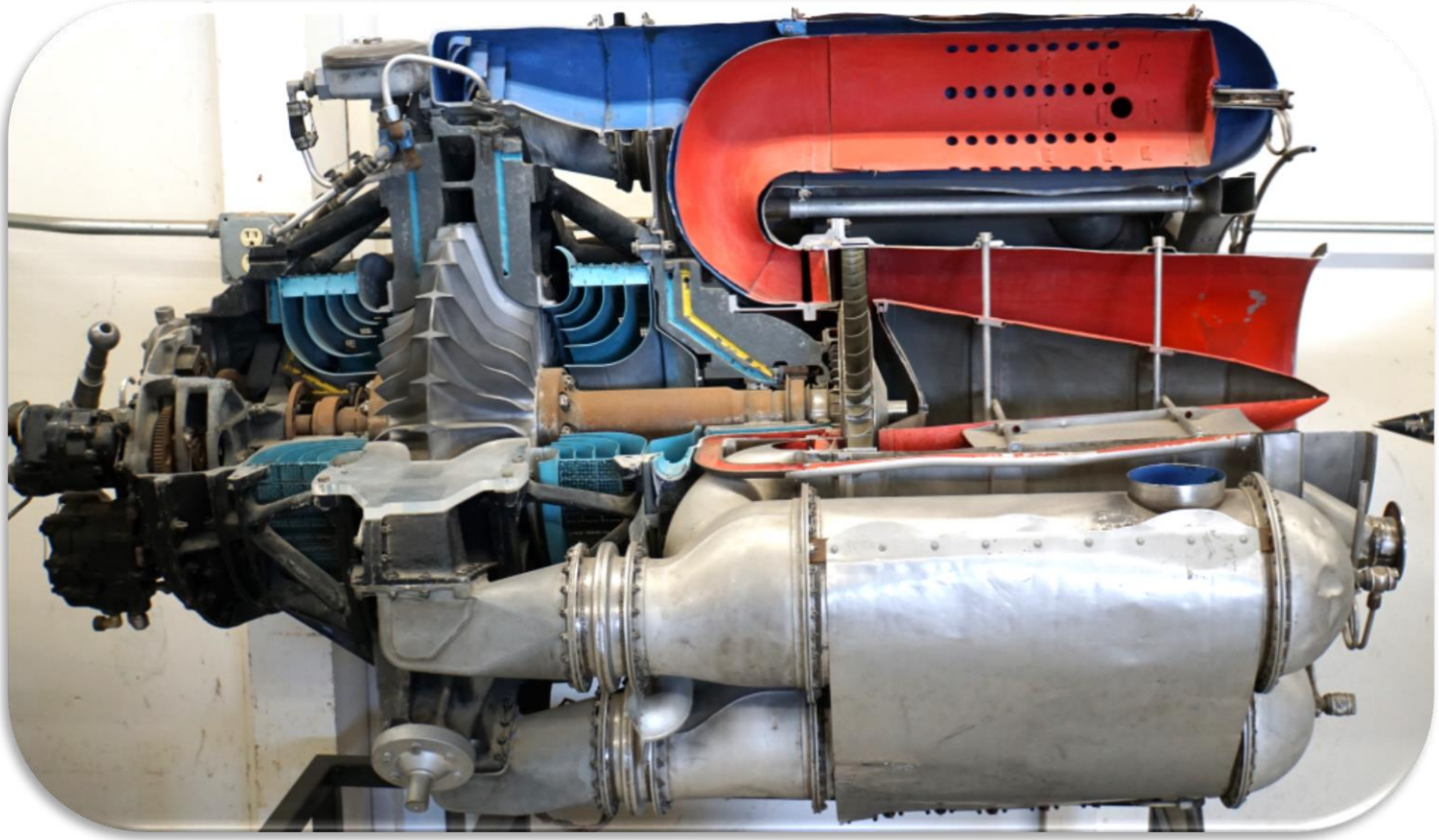

1st Run: 1943

Key Points: **General Electric I-16** (**Original**)(also known as the **General Electric J31**) was the **first turbojet engine mass produced in the United States** and was based on the British Whittle-1. **Two J31's powered the Bell P-59A Airacomet (Air Force's first aircraft with a jet engine)** and the Ryan FR Fireball during World War II. It produced 1,650 lbs. of thrust and had a maximum compressor speed of 16,500 rpm. **241 engines were built** during World War II. When the war ended, the I-16 contract was cancelled.

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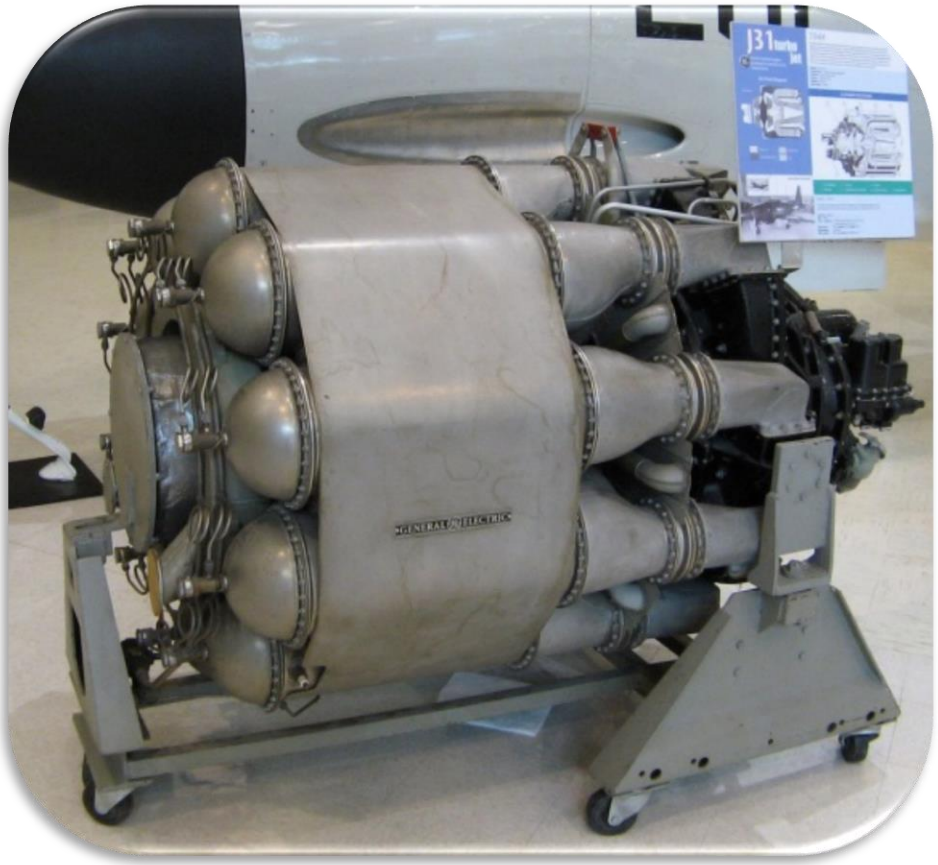
Hangar 1 Engines



General Electric I-16 Turbojet Engine

Patterned after the A-1, America's first jet engine, the I-16 reflected new technologies in compressor design and higher temperature material. First tested in April 1943, this engine produced 1650 pounds of thrust. Two hundred and forty-one I-16 turbojets were delivered to the U. S. Air Force to power the Bell Airacomet P-59A.

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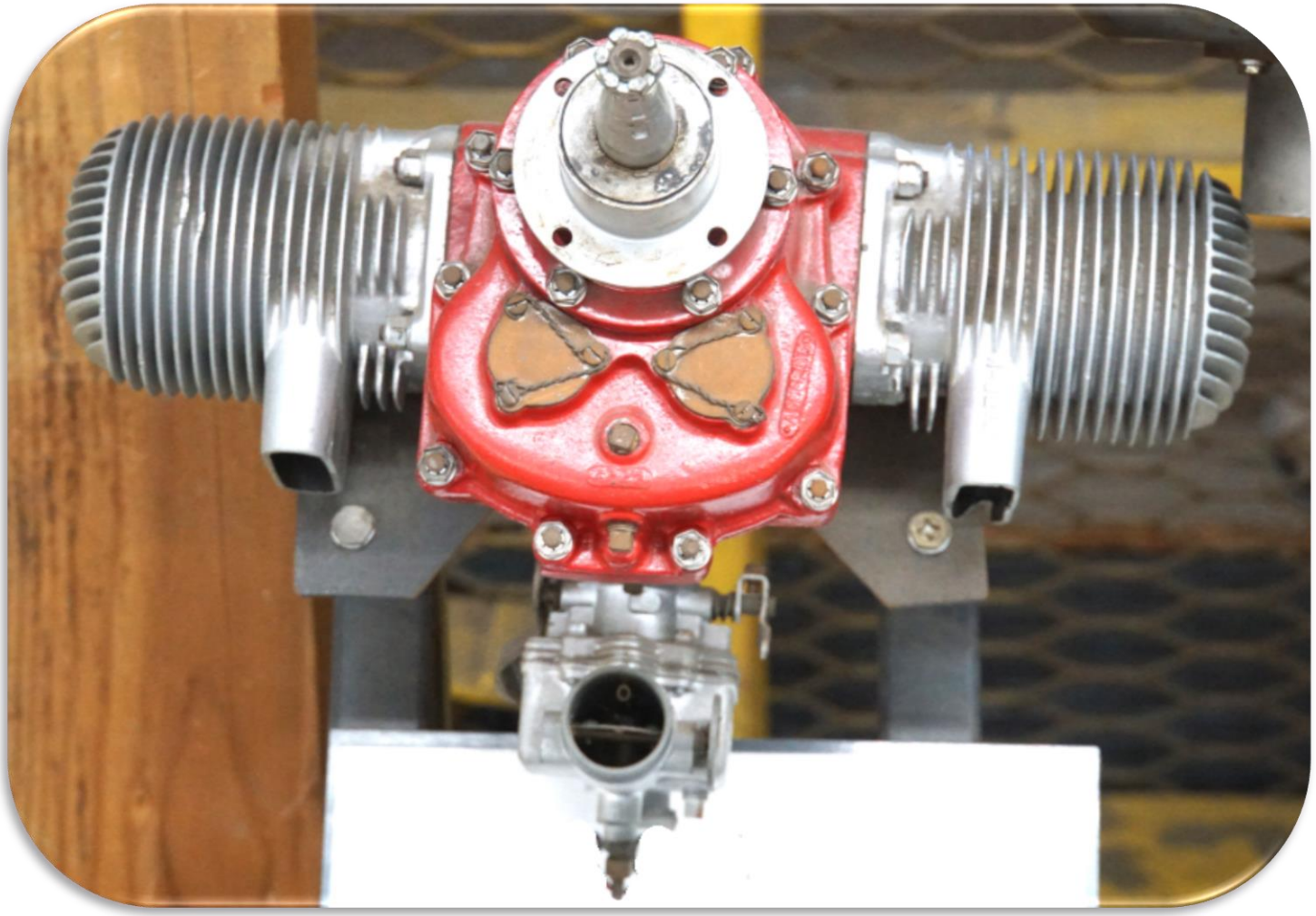

1st Run: 1940's

Key Points: **Righter/Kiekhaefer O-45** (**Original**) was an air-cooled, two-stroke aircraft engine of horizontal opposed configuration, used extensively for powering target drones in the late 1940s. **Also used in the Museums Wee Bee aircraft**. Two versions produced either 20 or 35 hp.

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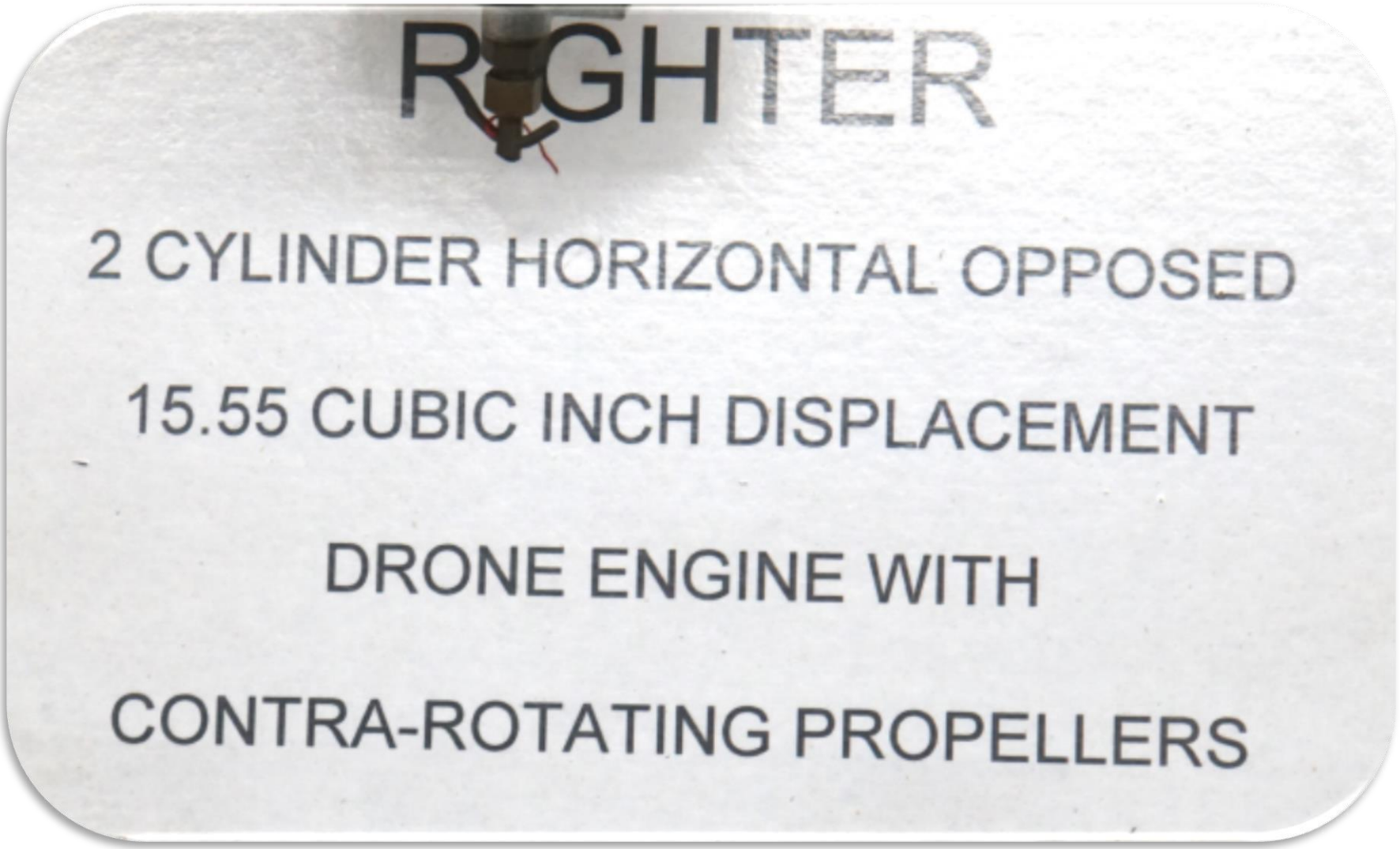
RIGHTER
2 CYLINDER HORIZONTAL OPPOSED
15.55 CUBIC INCH DISPLACEMENT
DRONE ENGINE WITH
CONTRA-ROTATING PROPELLERS

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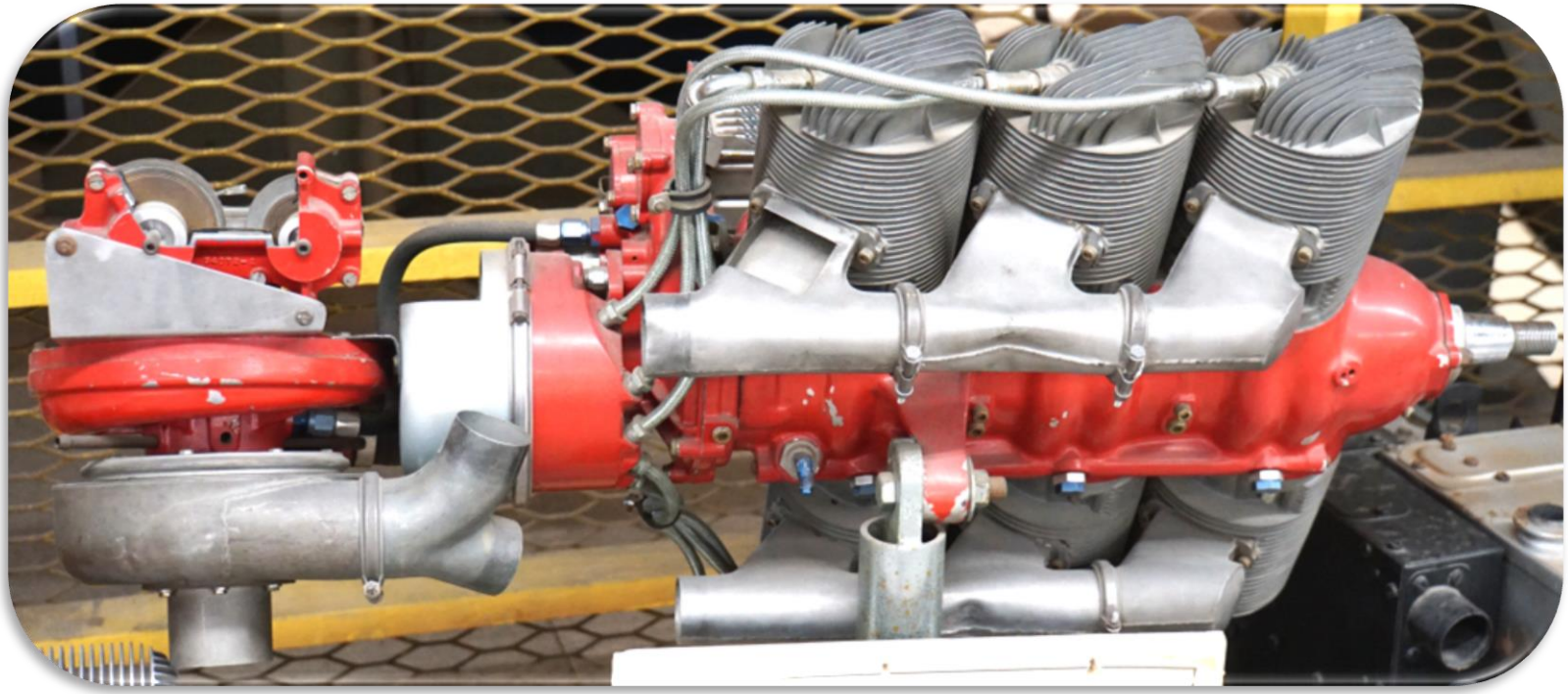

1st Run: 1946

Key Points: **McCulloch 6318 (Navy 0-150-2)** (**Original**) McCulloch Motors Corp., Los Angeles, CA , produced **drone engines**, all of which were air-cooled, rotary-valve, gasoline-fueled two-strokes. The 6-cylinder Model 6318 (O-150-2) displaced 149.62 in^3, produced from 110 hp at 4,100 rpm, weighed 114 lb, and was built from 1955 until 1972.

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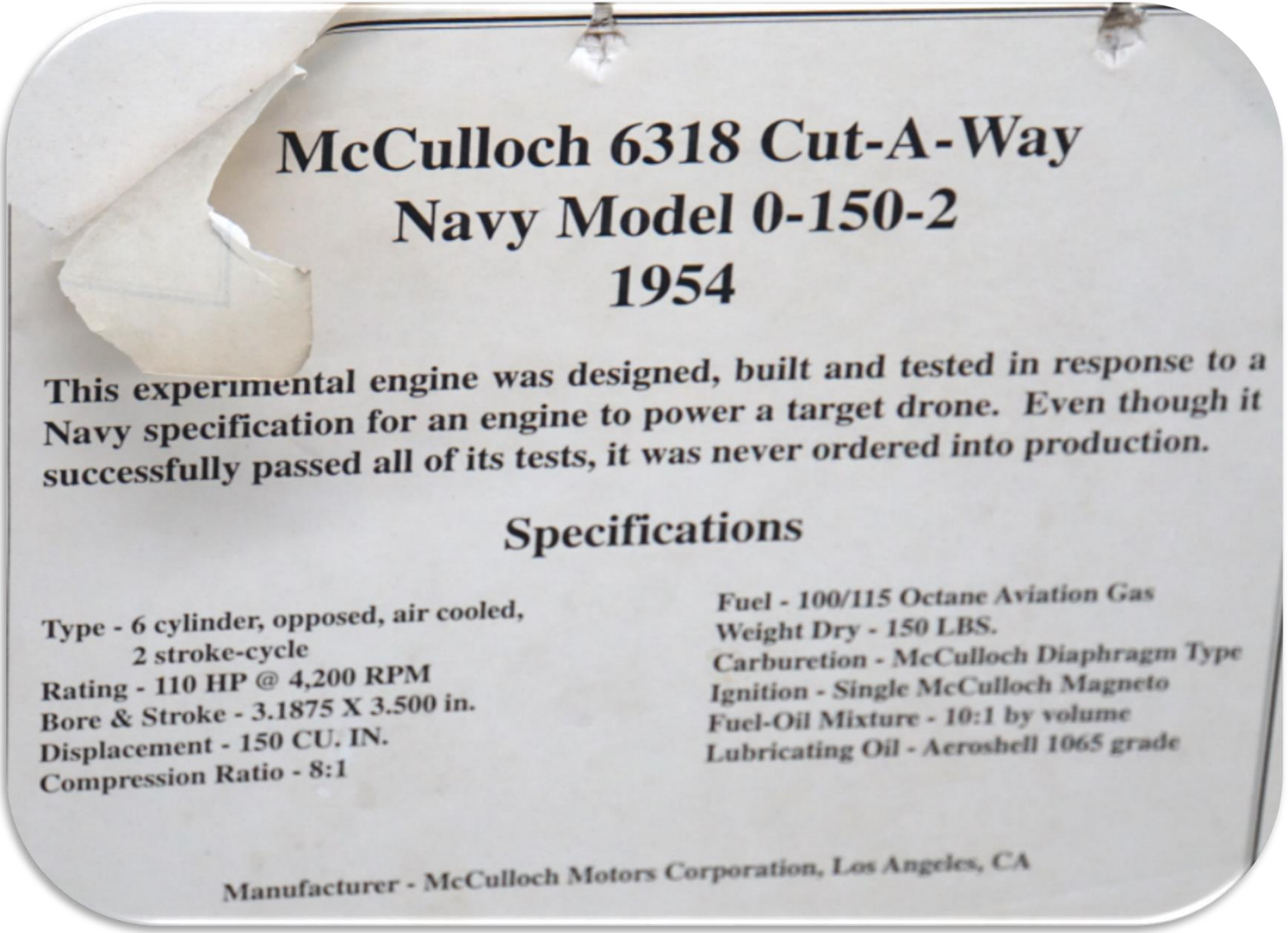

McCulloch 6318 Cut-A-Way
Navy Model 0-150-2
1954

This experimental engine was designed, built and tested in response to a Navy specification for an engine to power a target drone. Even though it successfully passed all of its tests, it was never ordered into production.

Specifications

Type - 6 cylinder, opposed, air cooled,
2 stroke-cycle
Rating - 110 HP @ 4,200 RPM
Bore & Stroke - 3.1875 X 3.500 in.
Displacement - 150 CU. IN.
Compression Ratio - 8:1

Fuel - 100/115 Octane Aviation Gas
Weight Dry - 150 LBS.
Carburetion - McCulloch Diaphragm Type
Ignition - Single McCulloch Magneto
Fuel-Oil Mixture - 10:1 by volume
Lubricating Oil - Aeroshell 1065 grade

Manufacturer - McCulloch Motors Corporation, Los Angeles, CA

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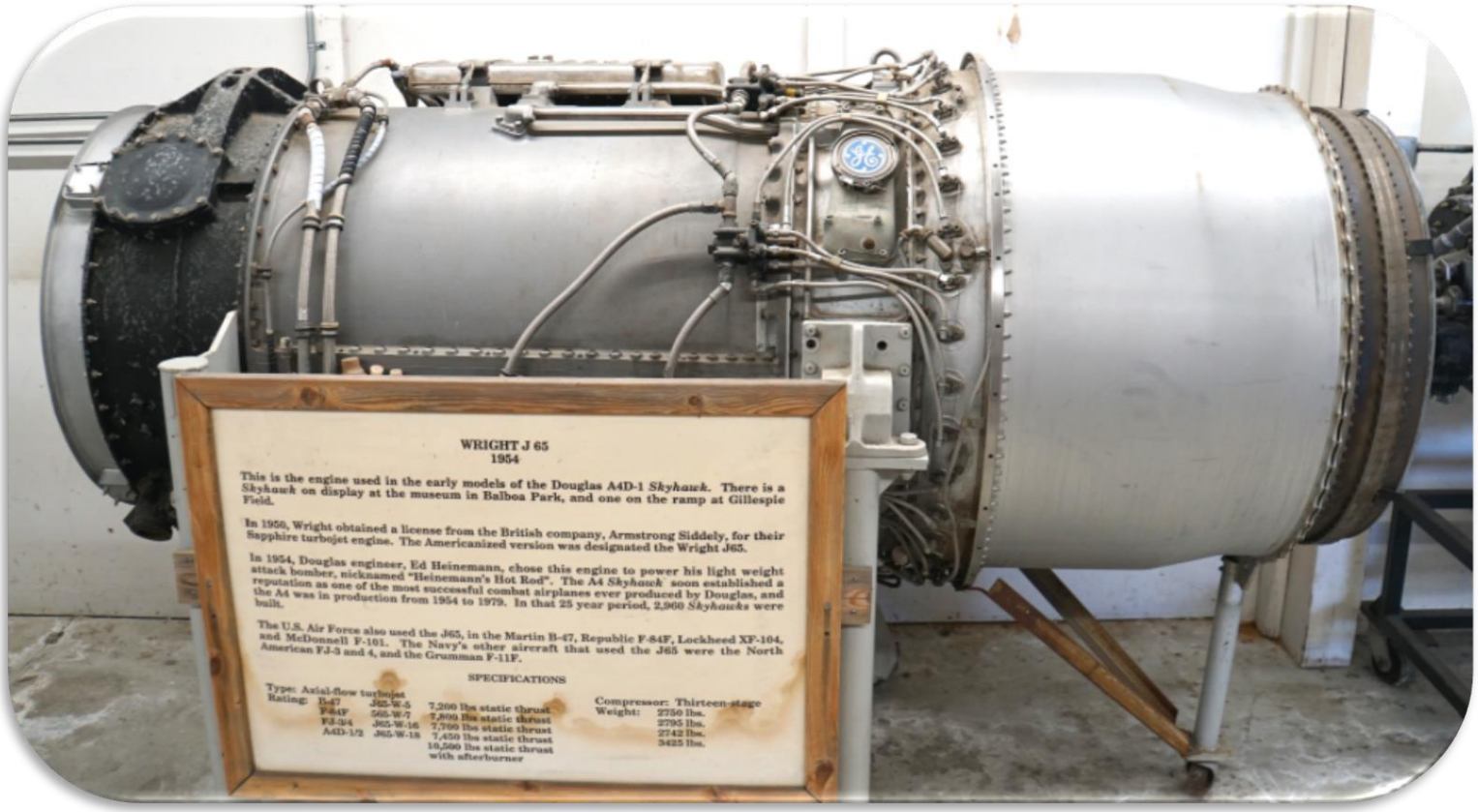
Hangar 1 Engines


WRIGHT J 65
1954
This is the engine used in the early models of the Douglas A4D-1 Skyhawk. There is a Skyhawk on display at the museum in Balboa Park, and one on the ramp at Gillespie Field.
In 1950, Wright obtained a license from the British company, Armstrong Siddely, for their Sapphire turbojet engine. The Americanized version was designated the Wright J65.
In 1954, Douglas engineer, Ed Heinemann, chose this engine to power his light weight attack bomber, nicknamed "Heinemann's Hot Rod". The A4 Skyhawk soon established a reputation as one of the most successful combat airplanes ever produced by Douglas, and the A4 was in production from 1954 to 1979. In that 25 year period, 2,960 Skyhawks were built.
The U.S. Air Force also used the J65, in the Martin B-47, Republic F-84F, Lockheed XF-104, and McDonnell F-101. The Navy's other aircraft that used the J65 were the North American FJ-3 and 4, and the Grumman F-11F.
SPECIFICATIONS
Type: Axial-flow turbojet
Rating: B-47 J65-W-5 7,200 lbs static thrust
F-84F 565-W-7 7,800 lbs static thrust
FJ-3/4 J65-W-16 7,700 lbs static thrust
A4D-1/2 J65-W-18 7,450 lbs static thrust
10,500 lbs static thrust with afterburner
Compressor: Thirteen-stage
Weight: 2750 lbs.
2795 lbs.
2742 lbs.
3425 lbs.

1st Run: 1951

Key Points: **Wright J65** (**Original**) was an axial-flow turbojet engine produced by Curtiss-Wright. While its original application was for the Martin **B-57 Canberra**, the J65 went on to power versions of the North American **FJ-3/4 Fury**, Douglas **A-4 Skyhawk**, Republic **F-84F Thunderstreak**, **B-47 Stratojet** and two Lockheed **XF-104 Starfighter** prototypes.

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WRIGHT J 65
1954

This is the engine used in the early models of the Douglas A4D-1 *Skyhawk*. There is a *Skyhawk* on display at the museum in Balboa Park, and one on the ramp at Gillespie Field.

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SPECIFICATIONS

Type: Axial-flow turbojet

Rating:			Compressor: Thirteen-stage
B-47	J65-W-5	7,200 lbs static thrust	Weight: 2750 lbs.
F-84F	565-W-7	7,800 lbs static thrust	2795 lbs.
FJ-3/4	J65-W-16	7,700 lbs static thrust	2742 lbs.
A4D-1/2	J65-W-18	7,450 lbs static thrust	3425 lbs.
		10,500 lbs static thrust with afterburner	

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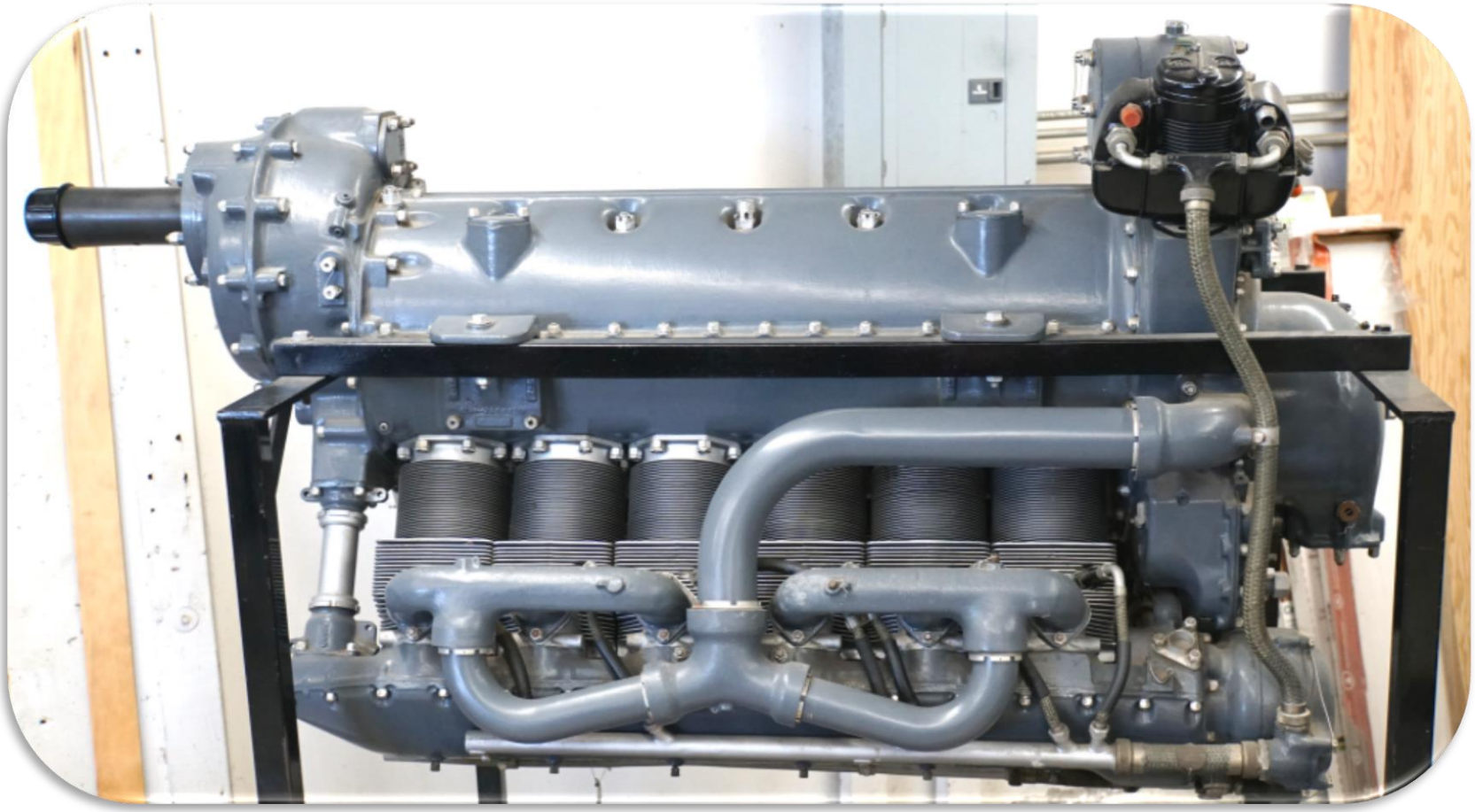
Hangar 1 Engines



1st Run: 1931

Key Points: **Ranger V-770** (**Original**) A **rare example of an American air-cooled inverted V-12 engine** developed by the Ranger Aircraft Engine Division (Fairchild Engine & Aircraft Corp). Produced from 1941 to 1945, it produced 520 hp @3150 rpm with supercharger. The **only American inverted V12-type inline air-cooled engine to reach production. About 1000 of the engines were built.**

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1939

Ranger SGV-770-C1

Curtiss Seamew

History

The Ranger SGV-770 V-12 is one of a very few US examples of an inverted V-type engine, although the layout was widely used in Germany and France until the end of World War II. Beginning with a series of well-regarded air cooled six-cylinder power plants, Ranger increased the displacement and power of their engines until the early 1930's, when they decided to compete in the over 300 hp market by building a V-12. Using the same basic cylinder size and design as their current inverted air cooled six, Ranger began development of the SGV-770. Early versions produced 250 - 300 hp, but the engine was gradually developed to have higher speed, geared propeller drive, and supercharging. By World War II, when it finally found a production application in the rather notorious Curtiss S03C Seamew observation aircraft, the engine's power had been raised to over 500hp. About 1000 of these aircraft and engines were built.

Technical Details

The SGV-770 followed typical Ranger practice in having steel finned cylinders bolted to a split aluminum crankcase. It had a single "underhead" camshaft for each bank, operating two valves per cylinder in hemispherical combustion chambers. The cams were driven by shafts and gears at the front of the engine, and the magnesium camshaft housings served as oil sumps for the dry-sump lubrication system. Exhaust ports were on the inside of the Vee between banks of cylinders, and exhaust discharged via short pipes through the bottom of the fuselage. The single-stage, single-speed, centrifugal supercharger was mounted at the rear of the engine, and drew air through an updraft Holly non-icing carburetor. Dual Scintilla magnetos fired two plugs per cylinder.

Type:	Inverted 60-degree V-12; air cooled; geared
Displacement:	773 cubic inches
Compression Ratio:	6.5 : 1
Valve Arrangement:	Two valves per cylinder; single "underhead" camshaft
Induction System:	Single-stage, 1-speed supercharger; single updraft carburetor
Weight:	740 lbs
Power Rating:	520 horsepower at sea level, max.takeoff; 3150 RPM
Fuel Consumption:	0.55 lb/hr per hp

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Hangar 1 Engines

1st Run: 1934

Key Points: **Continental R-670** (**Original**) A seven-cylinder four-cycle radial aircraft engine produced by Continental displacing 668 cubic inches and a dry weight of 465 lb . Horsepower varied from 210 to 240 at 2,200 rpm. The engine was the **successor to Continental's first radial engine, the 170 hp Continental A-70.** This engine was used on many aircraft in the 1930s and 1940s. The R-670 was widely used in the PT-17 Stearman primary training aircraft of the U.S. military.

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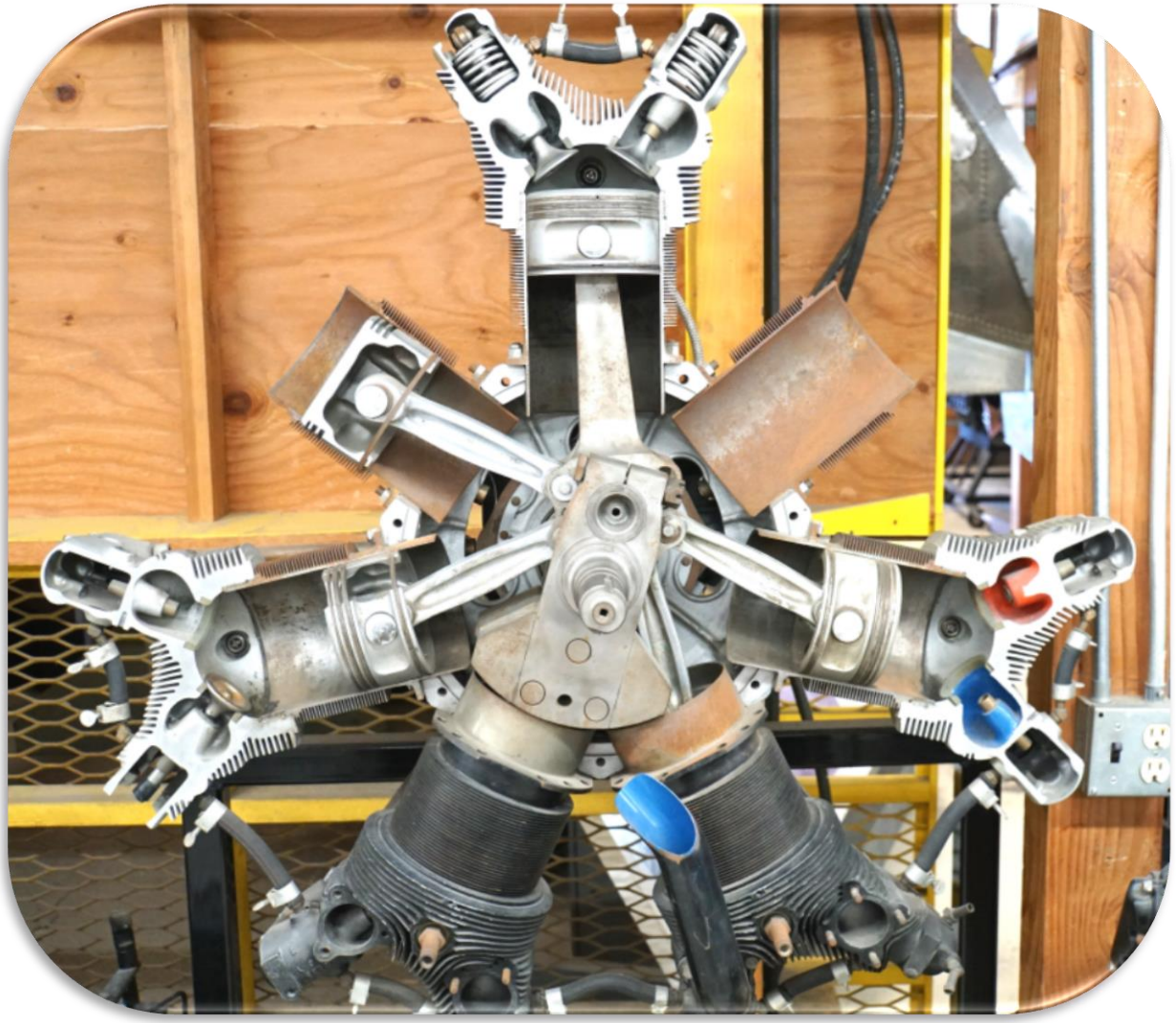
Hangar 1 Engines



Key Points: **Continental R-670 cutaway display.**

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Hangar 1 Engines

1st run: 1944

Key Points: **Pratt & Whitney R-4360 Wasp Major** (**Original**) an very successful American **28-cylinder four-row radial piston aircraft engine** designed and built during World War II, and the **largest-displacement aviation piston engine to be mass-produced in the United States**. It was the **last of the Pratt & Whitney Wasp family**, and the culmination of its maker's piston engine technology. Major applications: **Boeing 377, B-50 Superfortress, C-97 Stratofreighter, Convair B-36, and Fairchild C-119 flying Boxcar**.

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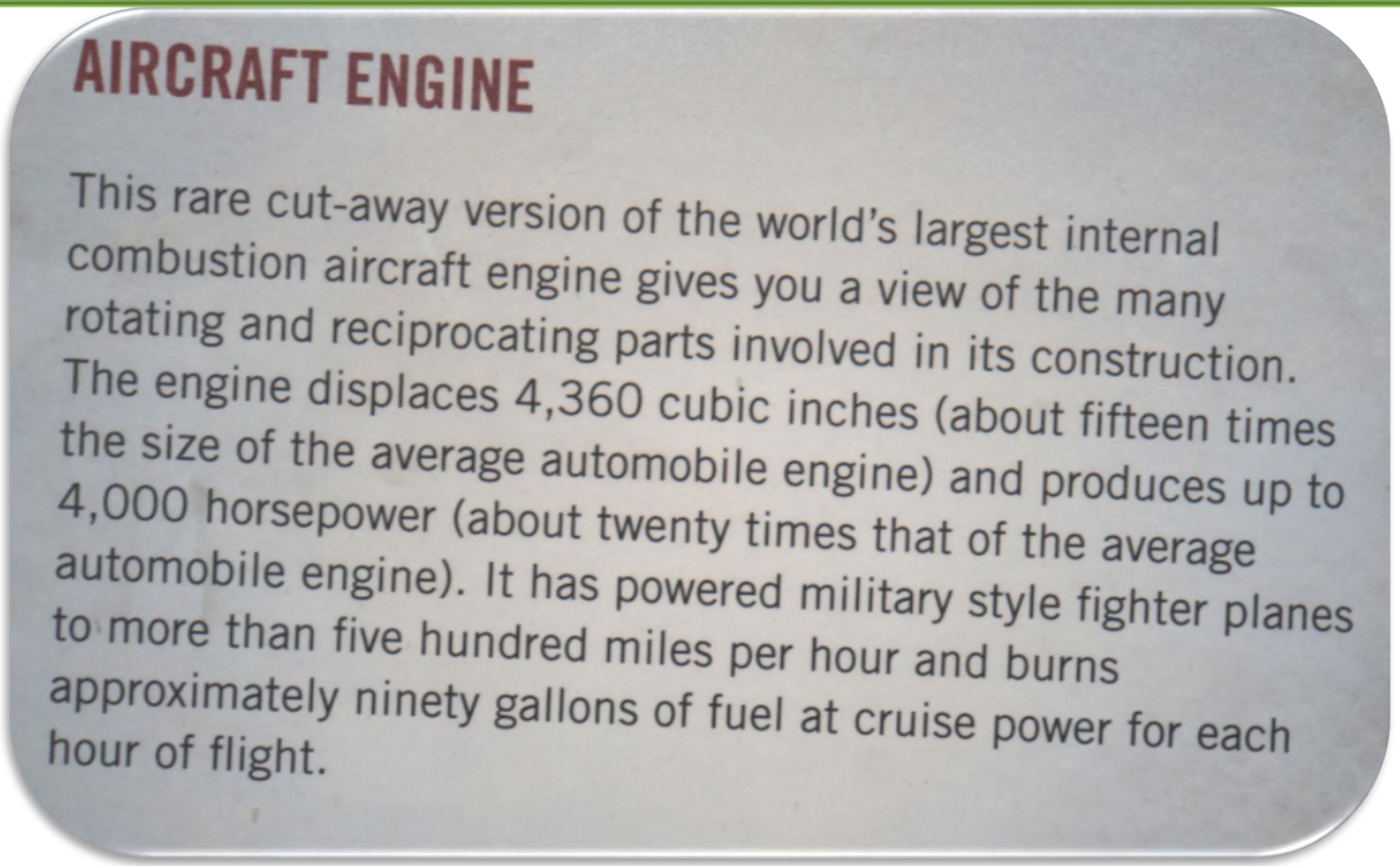
AIRCRAFT ENGINE
This rare cut-away version of the world's largest internal combustion aircraft engine gives you a view of the many rotating and reciprocating parts involved in its construction. The engine displaces 4,360 cubic inches (about fifteen times the size of the average automobile engine) and produces up to 4,000 horsepower (about twenty times that of the average automobile engine). It has powered military style fighter planes to more than five hundred miles per hour and burns approximately ninety gallons of fuel at cruise power for each hour of flight.

Extra Info: Wasp Majors were produced between 1944 and 1955; **18,697 were built**.

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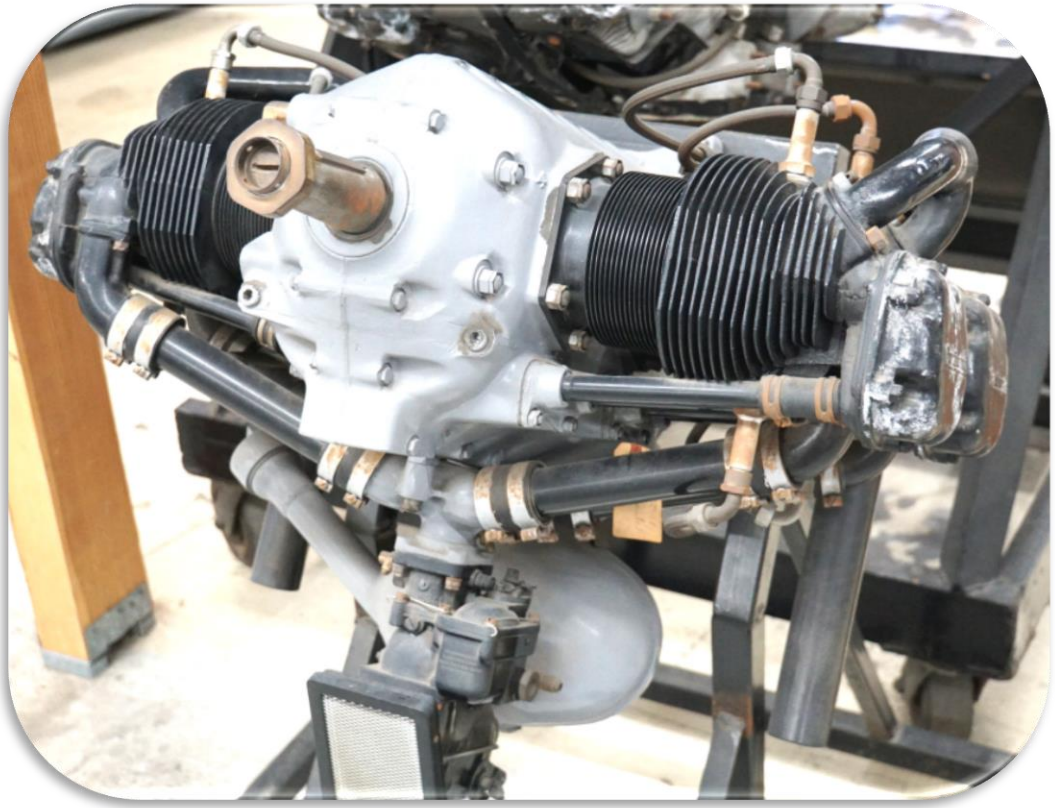
Hangar 1 Engines



1st Run: 1930's

Key Points: **Continental A-80-6J** (**Original**) a **horizontally opposed, four-cylinder engine family** are all identical in appearance, bore, stroke, dry weight, and piston displacement. All feature a bottom-mounted updraft carburetor fuel delivery system. The higher power variants differ only in compression ratio and maximum allowable rpm, plus minor modifications. The lower power versions are fully convertible to the higher rated versions. **Powered thousands of Taylor Cubs, Piper Cubs, Taylorcraft airplanes and all models of WWII liaison aircraft.**

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Continental A-80-6J
1941

During the 1920s, Continental Motors was the world's largest maker of internal combustion engines. Continental engines were used in cars and commercial vehicles built by other manufacturers. During the decade of the 1930s, the 37-40 hp Continental A-40 powered thousands of Taylor Cubs, Piper Cubs and Taylorcraft Airplanes. In 1940, Continental introduced the 65 hp A-65, which powered every make and model of WWII liaison aircraft. To meet demand for still higher rated horsepower the 80 hp A-80-6J engine was introduced by Continental Motors.

Specifications

Type - 4 Cylinder, Opposed, Air Cooled
Rating - Maximum Continuous at S.L.
80 hp @ 2,700 rpm
Bore & Stroke - 3.875 in. X 3.625 in.
Displacement - 171 cu. in.
Compression Ratio - 7.5:1

Weight Dry - 171 lbs
Propeller Shaft - SAE No. 0, Tapered
Carburetion - Stromberg NA-83A1
Ignition - Dual Scintilla SF-4R Magnetos
Fuel - 80 Minimum Octane Aviation Gasoline
Approved Type Certificate No. 217

Donated by Paul Whittier of Los Angeles in 1980

Manufacturer

The Continental Motors Corporation Aircraft Engine Division
Muskegon, Michigan

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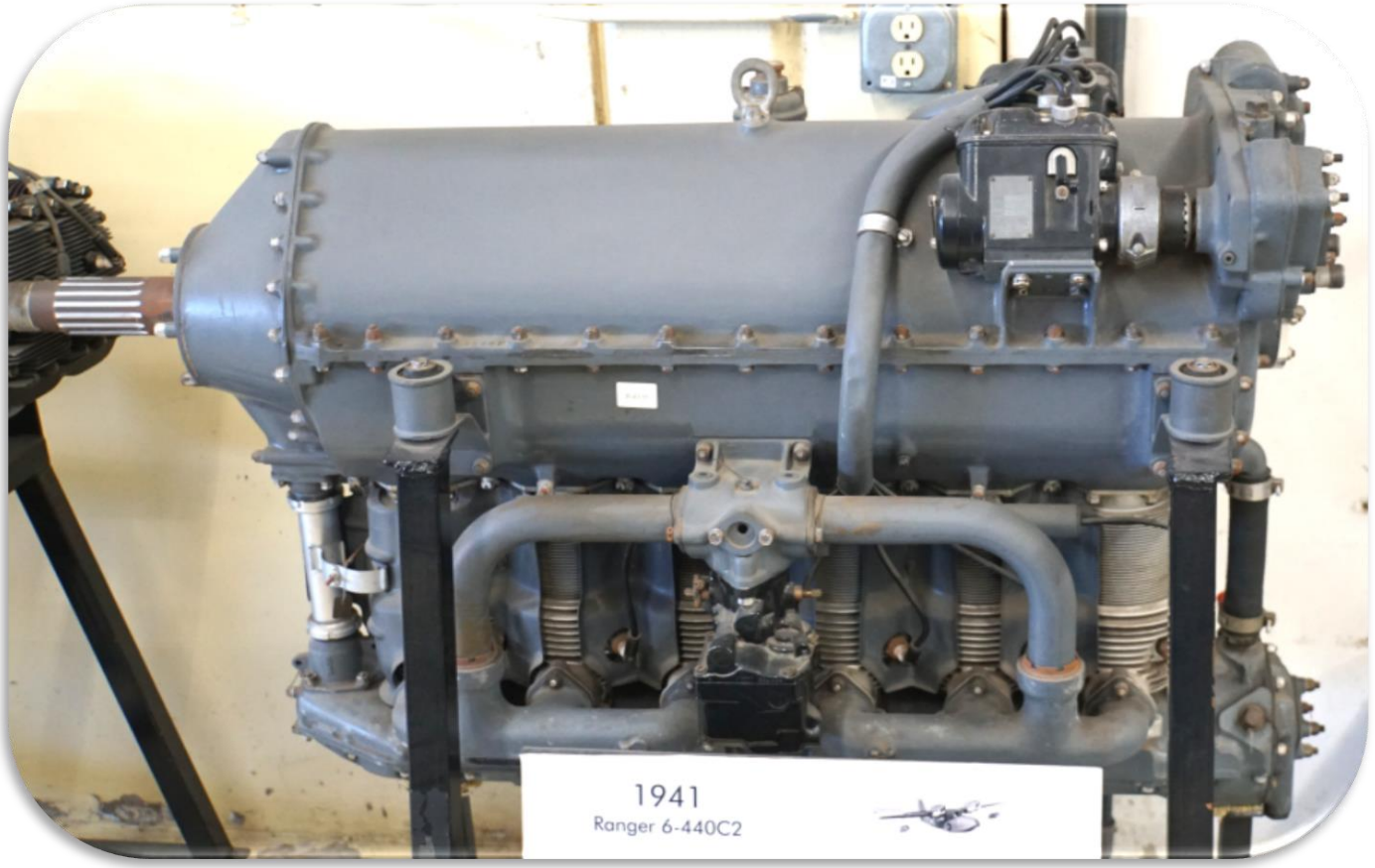
Hangar 1 Engines



1st Run: 1941

Key Points: **Ranger 6-440C** (**Original**) are **six-cylinder inline inverted air-cooled aero-engines** produced by the Ranger Aircraft Engine Division, Fairchild Engine and Airplane Corporation, Farmingdale, New York. The engine was mainly produced for Fairchild's family of training aircraft in the mid-1930s. Very smooth running with power ratings up to 200 hp. **About 6600 produced during WWII**.

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1941
Ranger 6-440C2

Grummann Widgeon

History

The 6-cylinder Ranger 6-440 is typical of the four and six cylinder inline, inverted air-cooled engines that were widely used in the light plane market in the 1930s and 1940s. Rangers were built by the Fairchild Engine and Aircraft Corp. of New York, and most were inverted sixes in the same low to middle displacement class as other builders' fours. The Rangers were noted for their smooth operation due to the inherent balance of the inline six layout. The 6-440, the largest and last of Ranger's sixes, was introduced in 1941, and powered Fairchild's PT-19 and PT-26 trainers. About 6600 of these engines were built during the war years.

Technical Details

Although built in a range of sizes, all Ranger sixes had similar construction. Finned steel cylinder barrels were bolted to a two-piece aluminum crankcase that supported the 7-bearing crankshaft equipped with vibration dampers. The aluminum heads contained two valves and two spark plugs per cylinder, and formed a hemispherical combustion chamber. The single "underhead" camshaft was driven by a shaft and gears at the front of the engine, and its magnesium housing served as the inverted engine's lower oil sump. Different models had differing compression ratios, depending on the fuel octane rating specified. Power ratings ranged up to 200 horsepower.

Type:	Inverted, inline 6-cylinder; air cooled	Induction System:	Single updraft Stromberg carburetor
Displacement:	441 cubic inches	Weight:	376 pounds
Compression Ratio:	6.0:1	Power Rating:	175 horsepower at sea level, 2450 RPM
Valve Arrangement:	Two overhead valves per cylinder; single "underhead" camshaft		

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1st Run:
1937 or 38

Key Points: **Menasco M50** (**Original**) was a 4-cylinder horizontally-opposed engine developed from 1937-1938 for use in **Aeronca model KM light planes**. Despite an order for 500 Menasco M50 engines, **only 10 engines were delivered**. Initially designed for aircraft, the M50's were also used to power midget race cars. Failure of the engine in the market could be attributed to the late entry for the engine into the market. It was soon overshadowed by more technologically advanced engines.

This: Factory new with only test stand time logged. Donated 1994 by Jack Nees of Palm Springs.

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MENASCO M-50 (1938)

The 1931 Continental A-40 is justifiably credited with starting the present day popularity of the flat or opposed aircraft engines of under 400HP. However, it was not the first flat four. That honor goes to the French company, Societe Antoinette who produced one in 1908.

By 1937, a half dozen aircraft engine manufacturers were burning the midnight oil trying to produce an engine with more power than the Continental but at a similar weight and cost. One of these was Al Menasco.

Because of poor market research, Menasco was late in coming out with his M-50 at 50 HP. His first customer for his new engine was Aeronca who used it in their new model KM. Its performance met all expectations but was soon eclipsed by Continental, Lycoming and Franklin who, by now, were all producing 65 HP engines. Consequently, only ten Aeronca KMs were sold, and since no other airplane manufacturer purchased the M-50, only a few were ever built. Menasco then decided to concentrate on his very successful four and six cylinder inverted in-line engines that were then used in many racing airplanes.

This engine on display is factory new with only factory test stand time in its logbook.

SPECIFICATIONS

TYPE - 4 cylinder, opposed, air cooled
RATING - 50 HP @ 2,500 RPM
BORE & STROKE - 3.50 in. X 3.75 in.
DISPLACEMENT - 144.4 cu. in.
FUEL - 73 Octane aviation gas

COMPRESSION RATIO - 5.25:1
WEIGHT DRY - 167 lbs.
PROPELLER SHAFT - SAE NO. 0 taper
CARBURETION - Stromberg NA-S3
IGNITION - Single, Bendix-Scintilla SF-4L magneto

Approved Type Certificate No. 191
MANUFACTURER - Menasco Manufacturing Company, Los Angeles, California

Donated in 1994 by Jack Nees of Palm Springs, California

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Hangar 1 Engines

1st Run: 1929

Key Points: Menasco 4A (Original) A four cylinder inverted in-line air cooled engine.
This: SN 101, was the **first engine produced by Menasco Manufacturing Co**. It passed the 50 hour full-throttle test for an ATC at Bureau of Standards, Wash DC in 1929. Powered the original **Northrop Flying Wing**. **Won 1st first race for Menasco at Burbank Airport, 1930**. It also powered an Avro, Great Lakes, Doak-Deeds biplane and was used in the development of 100 octane fuel.

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MENASCO 4A

FOUR CYLINDER INVERTED IN-LINE AIR-COOLED ENGINE

BORE:	4.5 INCHES
STROKE	5.125 INCHES
DISPLACEMENT:	326 CUBIC INCHES
COMPRESSION RATIO:	5.5:1
HORSEPOWER:	90
WEIGHT:	290 POUNDS, DRY

This engine, Serial Number 101, was the first produced by Menasco Manufacturing Company. It passed the 50 hour full-throttle test for an A.T.C. at the Bureau of Standards in Washington D.C. in 1929. It powered the original Northrop Flying Wing. It won the first race for Menasco at the dedication of the Burbank Airport on Memorial Day, 1930. It also powered an Avro, a Great Lakes, and a special Doak-Deeds biplane. It was used in the development of the first 100 octane fuel.

Hangar 1 Engines

1st Run: 1926

Key Points: There is a typo on the story board, this engine is a V-1570, not a V-1750. Curtiss V-1570 Conqueror was a **12-cylinder (V-12) liquid-cooled aircraft engine** (**Original**) Representing a more powerful version of the Curtiss D-12, the engine entered production in 1926 and flew in numerous aircraft. It was later given the military designation of V-1570 based on its displacement of 1,570 cubic inches. Up to **675 hp normally aspirated, up to 800 hp supercharged.**

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Curtiss Condor

1932
Curtiss Conqueror
V-1750

Curtiss P-6

History

The Curtiss Conqueror is a great example of the evolution of large V-12 engines in the late 1920s. Engine speeds had increased by about 50 percent and rigid cast aluminum cylinder blocks were being used more frequently. It produced 50 percent more power than the Liberty with less displacement. The Conqueror was introduced in 1926 and was used in the Consolidated P-30 and Curtiss P-6E fighters, the Curtiss Carrier Pigeon mail plane and the Curtiss Condor. Despite development of versions with more power, few Conquerors were built. The US military was interested mainly in radial engines and Curtiss merged with radial engine builder Wright Aeronautical in 1929. Development funds for the Conqueror dried up and the engine was out of production by 1934.

Technical Details

The Conqueror featured a 60-degree angle between cylinder banks, wider than the Liberty's 45-degree, but still producing a compact engine. It had two cast aluminum 6-cylinder blocks bolted to its aluminum dry-sump crankcase. Dual overhead cams operated four valves per cylinder and two plugs per cylinder were fired by a dual Scintilla magneto. The engine came in both geared and direct drive versions. Most Conquerors were not supercharged and produced up to 675 horsepower at takeoff. Some late versions had superchargers and developed up to 800 horsepower on high octane fuel.

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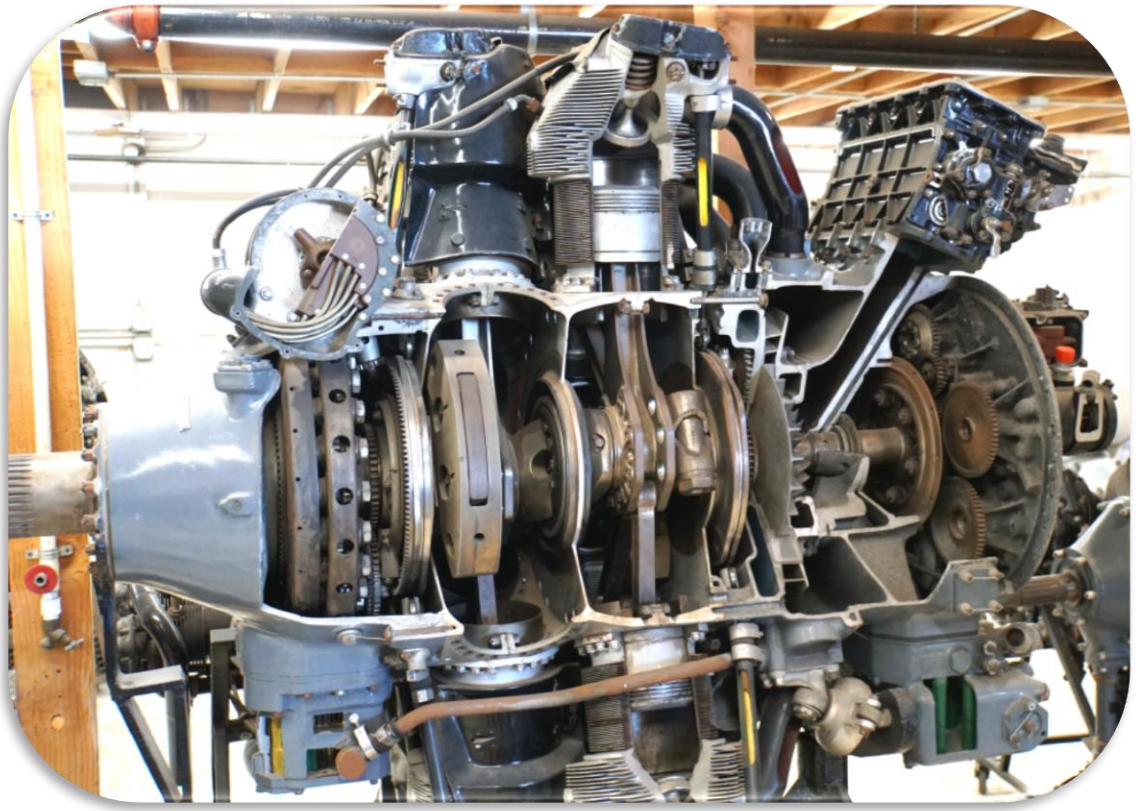

1st Run: 1937

Key Points: **Wright R-3350 Duplex-Cyclone** (**Original**) **twin-row, supercharged, air-cooled, radial aircraft engine with 18 cylinders** displacing nearly 3350 cu in. Power ranged from **2,000 to over 3,700 hp**. Used to power the **Boeing B-29 Superfortress**. After the war, used in the **Lockheed L-1049 Super Constellation** into the 1990s. Also used to power the **Lockheed P-2V Neptune**, **Lockheed L1049 Super Constellation**, and the **Douglas A-1 Skyraider**. Commonly used on Hawker Sea Fury and Grumman F8F Bearcat Unlimited Class Racers.

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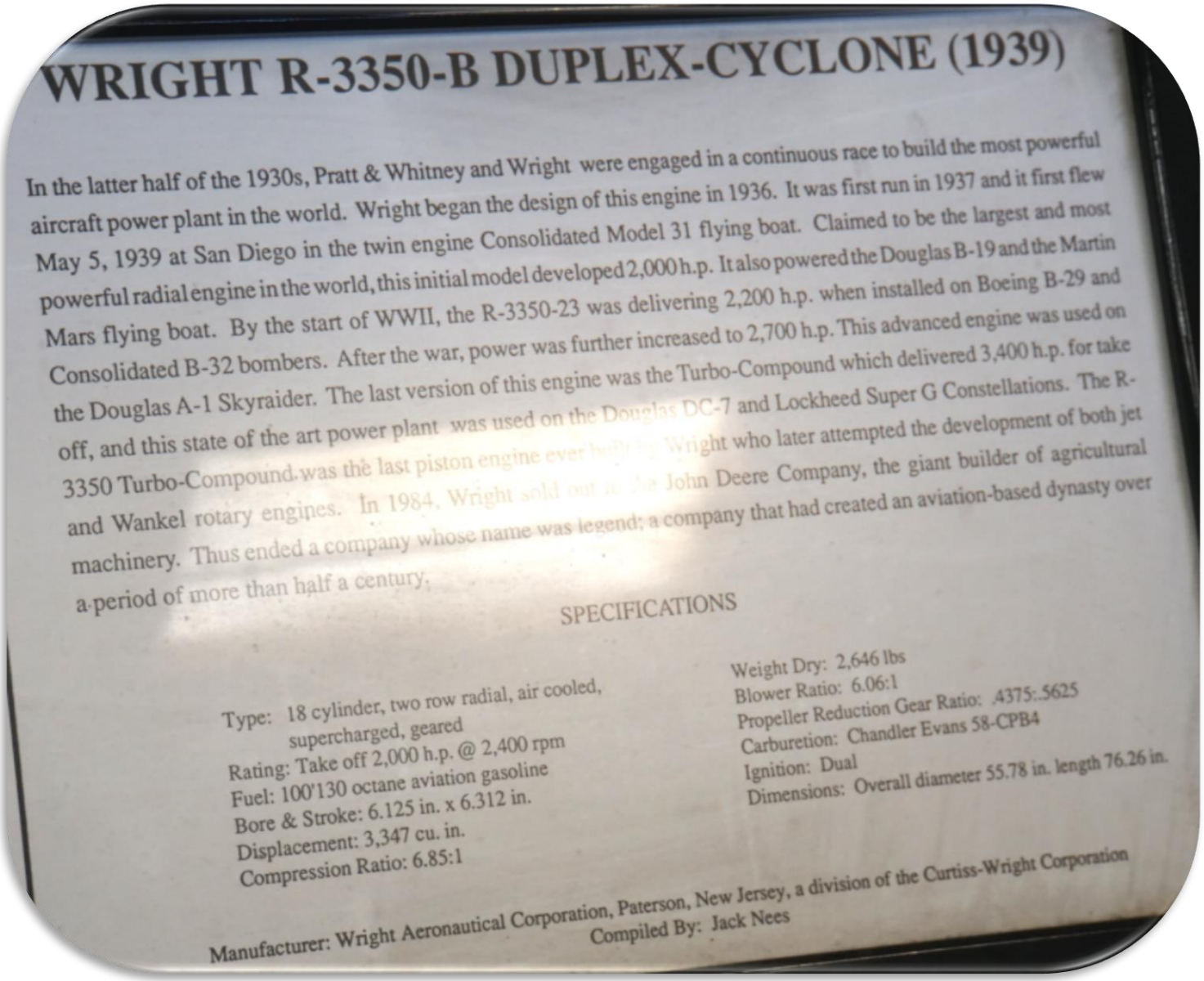
Hangar 1 Engines



WRIGHT R-3350-B DUPLEX-CYCLONE (1939)

In the latter half of the 1930s, Pratt & Whitney and Wright were engaged in a continuous race to build the most powerful aircraft power plant in the world. Wright began the design of this engine in 1936. It was first run in 1937 and it first flew May 5, 1939 at San Diego in the twin engine Consolidated Model 31 flying boat. Claimed to be the largest and most powerful radial engine in the world, this initial model developed 2,000 h.p. It also powered the Douglas B-19 and the Martin Mars flying boat. By the start of WWII, the R-3350-23 was delivering 2,200 h.p. when installed on Boeing B-29 and Consolidated B-32 bombers. After the war, power was further increased to 2,700 h.p. This advanced engine was used on the Douglas A-1 Skyraider. The last version of this engine was the Turbo-Compound which delivered 3,400 h.p. for take off, and this state of the art power plant was used on the Douglas DC-7 and Lockheed Super G Constellations. The R-3350 Turbo-Compound was the last piston engine ever built by Wright who later attempted the development of both jet and Wankel rotary engines. In 1984, Wright sold out to the John Deere Company, the giant builder of agricultural machinery. Thus ended a company whose name was legend; a company that had created an aviation-based dynasty over a period of more than half a century.

SPECIFICATIONS

Type: 18 cylinder, two row radial, air cooled, supercharged, geared
Rating: Take off 2,000 h.p. @ 2,400 rpm
Fuel: 100'130 octane aviation gasoline
Bore & Stroke: 6.125 in. x 6.312 in.
Displacement: 3,347 cu. in.
Compression Ratio: 6.85:1

Weight Dry: 2,646 lbs
Blower Ratio: 6.06:1
Propeller Reduction Gear Ratio: .4375:.5625
Carburetion: Chandler Evans 58-CPB4
Ignition: Dual
Dimensions: Overall diameter 55.78 in. length 76.26 in.

Manufacturer: Wright Aeronautical Corporation, Paterson, New Jersey, a division of the Curtiss-Wright Corporation
Compiled By: Jack Nees

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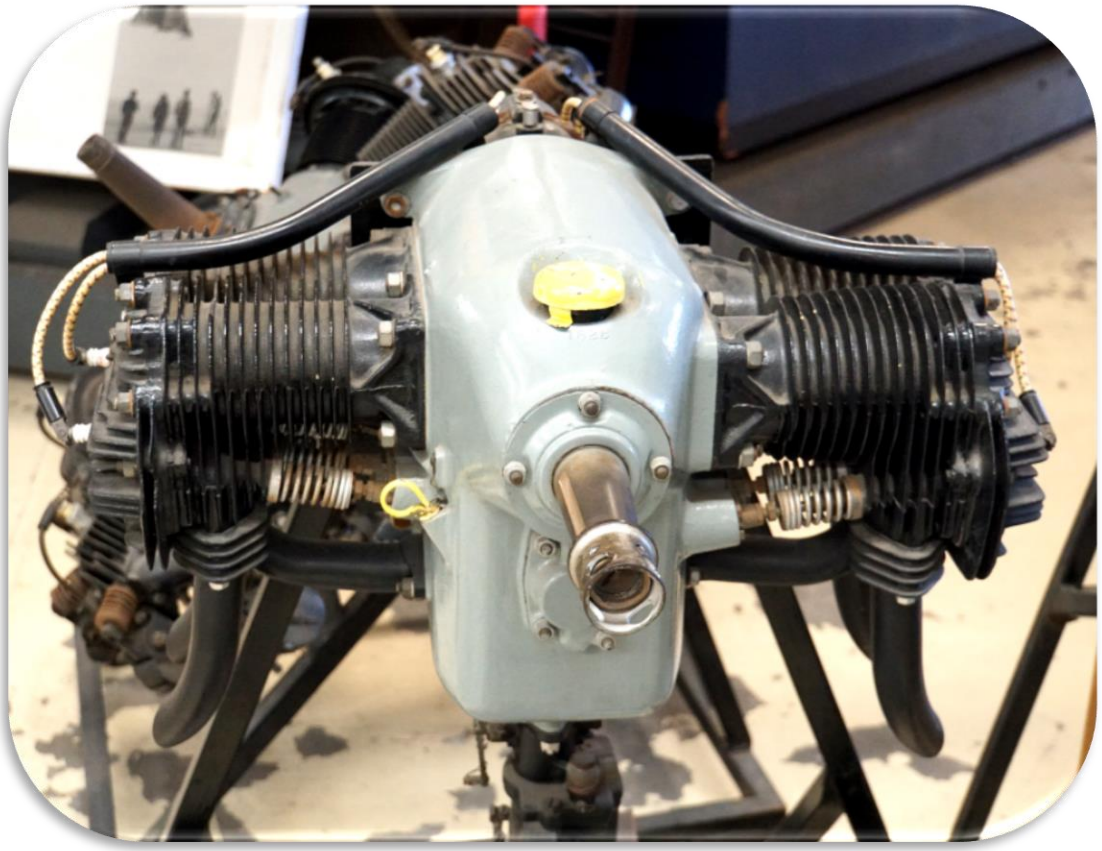
Hangar 1 Engines



1st Run: 1931

Key Points: **Continental A-40** (**Original**) engine is a **carbureted four-cylinder, horizontally opposed, air-cooled aircraft engine** that was developed especially for use in light aircraft by Continental Motors. It was produced between 1931 and 1941 and was the **first in Continental's very popular four-cylinder, horizontally opposed series engines.** Later inspired the A-50, A-65, A-80 and subsequent engines. **Powered thousands of Taylor Cubs, Piper Cubs, Taylorcraft airplanes and all models of WWII liaison aircraft.**

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Continental A-40 (1931)

Taylor E-2 Cub

History

Continental's A-40 was the first popular horizontally-opposed 4-cylinder aero engine, and is considered by some as the direct ancestor of all piston aircraft engines in production today. It was introduced in 1931 and selected to power the classic Taylor E-2 Cub. Over 3000 of these engines were built during their 1931 to 1938 production run. They (and the Taylor/Piper Cubs they powered) did much to keep private flying alive during the Great Depression, due in large part to their affordable $400 price tag.

Technical Details

A very simple engine, the A-40 had both cast-iron cylinders on each side cast together as a pair, complete with cooling fins. The aluminum heads were also cast as a pair and spanned both paired cylinders. There were two valves per cylinder operated by short pushrods in a L-head or "flathead" arrangement and a single, spark plug per cylinder fired by a Scintilla magneto. The single updraft carburetor was mounted to the bottom of the engine, feeding mixture through passages in the oil sump (thereby cooling the oil and heating the mixture to avoid icing) and then delivering it to the cylinders via external pipes. A forged steel, counterweighted crankshaft ran in only two plain bearings within the cast aluminum sump. The small 4-cylinder was smoother running than twins of the same power, and quickly became the favored type of light plane engine.

Aircraft with this engine

Taylor E-2 Cub

Specifications

Type:	Horizontally opposed 4-cylinder; air-cooled	Induction System:	Single updraft carburetor
Displacement:	115 cubic inches	Weight:	138 pounds
Compression Ratio:	5.2 : 1	Power Rating:	38 hp at sea level, 2800 RPM
Valve Arrangement:	Two valves per cylinder, pushrod operated; L-head arrangement	Fuel Consumption:	0.55 lb/hr per hp

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Hangar 1 Engines

One of a series of engines starting with **Eddie Rickenbacker's Detroit Aircraft Company's** original *Aircat* engines. Includes the *Velie, **LeBlond**, Lambert & Ken Royce* engines.

1st Run: 1930

Key Points: **LeBlond radial engines** (**Original**) later produced under the name **Ken-Royce**, were a family of 3-cylinder, 5-cylinder and 7-cylinder, air-cooled radial engines for aircraft, built in the 1930s by the **LeBlond Aircraft Engine Corporation** until the operation was sold to Rearwin Airplanes in 1937 and renamed **Ken-Royce Engines**.
This: **90 hp**, 5-cylinder, air-cooled, radial piston engine with a displacement of 266 cubic inches.

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Le Blond 5F
1936

The Le Blond Aircraft Engine Corporation was organized in early 1928 after Le Blond purchased the assets of WWI Ace, Captain Eddie Rickenbacker's Detroit aircraft engine corporation. Rickenbacker's company had produced the *Aircat*, a five cylinder radial engine developing 60-80 hp. Le Blond's parent company was well known at the time as the manufacturer of precision machine tools, and after acquiring Rickenbacker's company, La Blond was able to expand into the aircraft engine business.

Similar engines to the Le Blond were the *Velie* and the *Lambert*. Both were unauthorized copies of the *Aircat*, and to avoid patent infringement, both companies paid royalties to Le Blond.

In 1937, Le Blond sold the engine company to Rae Rearwin, and following his purchase, Rearwin continued to produce the engines, but he changed the name to *Ken-Royce*, which were the names of his two sons.

Donated by Leon Blood of Santee, CA in 1996.

Specifications

Type - 5 Cylinder Radial, Air Cooled
Rating - Maximum Continuous, 90 hp @ 2,250 rpm
Fuel - 73 Minimum Octane Aviation Gasoline
Fuel Consumption @ Cruise - 3.7 gal. per hour
Bore & Stroke - 4.25 in. X 3.25 in.
Displacement - 266 cu. in.
Compression Ratio - 6.1:1
Weight Dry - 222 lbs
Propeller Shaft - SAE No. 0, Tapered
Carburetions - Holley 429 or Stromberg NA-R3
Ignition - Dual Bosch FU-5 or Scintilla SB-5 Magnetos

Approved Type Certificate No. 46
Manufacturer - Le Blond Engine Corporation, Cincinnati, Ohio

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Hangar 1 Engines

1st Run: 1933

Key Points: **Lycoming O-145** (**Original**) is a family of small, low-horsepower, four-cylinder, air-cooled engines. It was Lycoming Engines' **first horizontally opposed aircraft engine** and was produced from 1938 until 1949. The family includes the reduction-geared GO-145. The O-145 received its Approved Type Certificate on 13 Jun 1938. Dash A model rated at **55 hp**, the Dash B rated at **65 hp**, and Dash C rated **at 75 hp**. The "B" model was the major production model.

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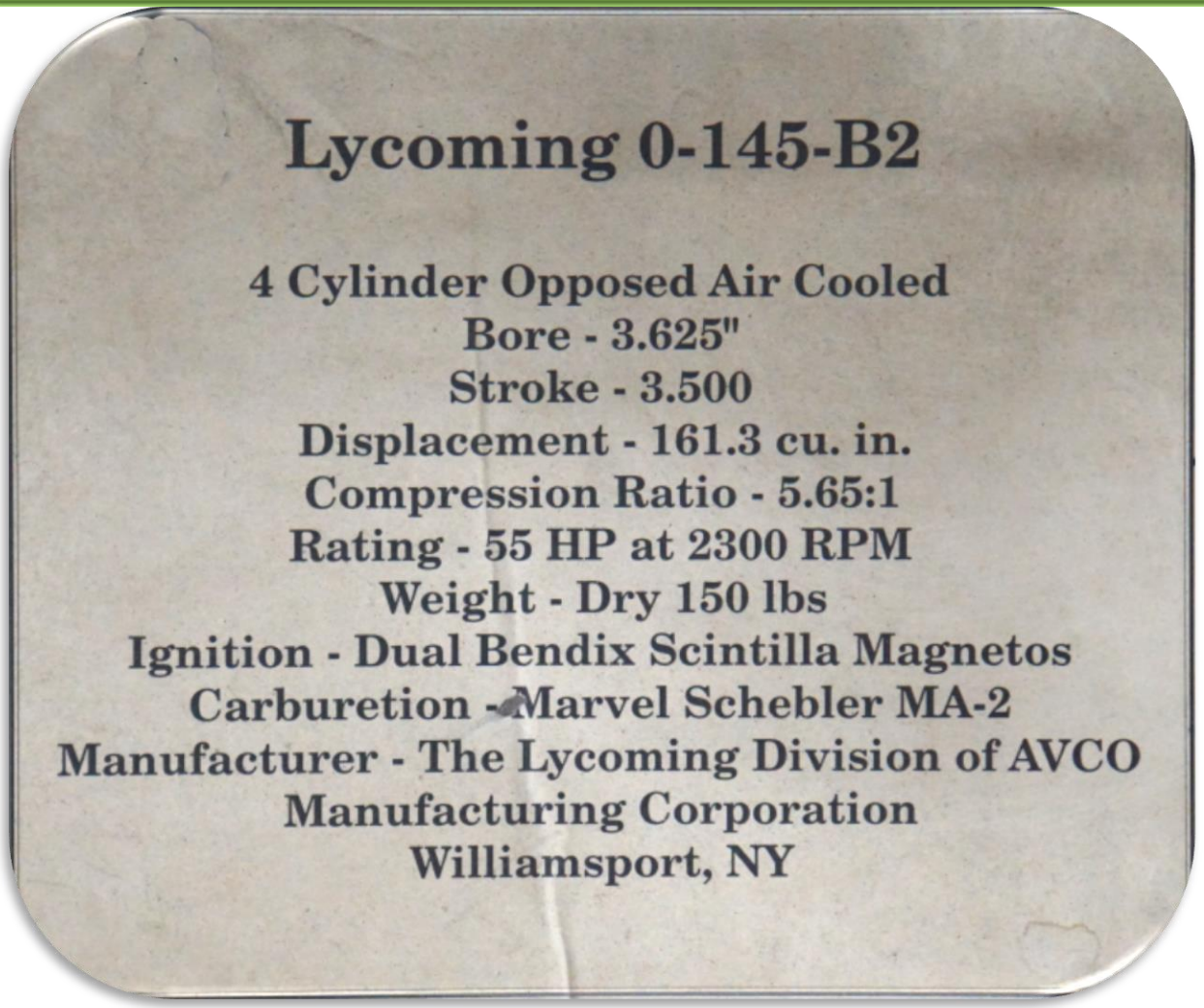
Lycoming 0-145-B2
4 Cylinder Opposed Air Cooled
Bore - 3.625"
Stroke - 3.500
Displacement - 161.3 cu. in.
Compression Ratio - 5.65:1
Rating - 55 HP at 2300 RPM
Weight - Dry 150 lbs
Ignition - Dual Bendix Scintilla Magnetos
Carburetion - Marvel Schebler MA-2
Manufacturer - The Lycoming Division of AVCO
Manufacturing Corporation
Williamsport, NY

Extra Info: Typo on the story board. The A series is 55hp, while the B series is 65hp. **This engine is a B series @ 65 hp**.

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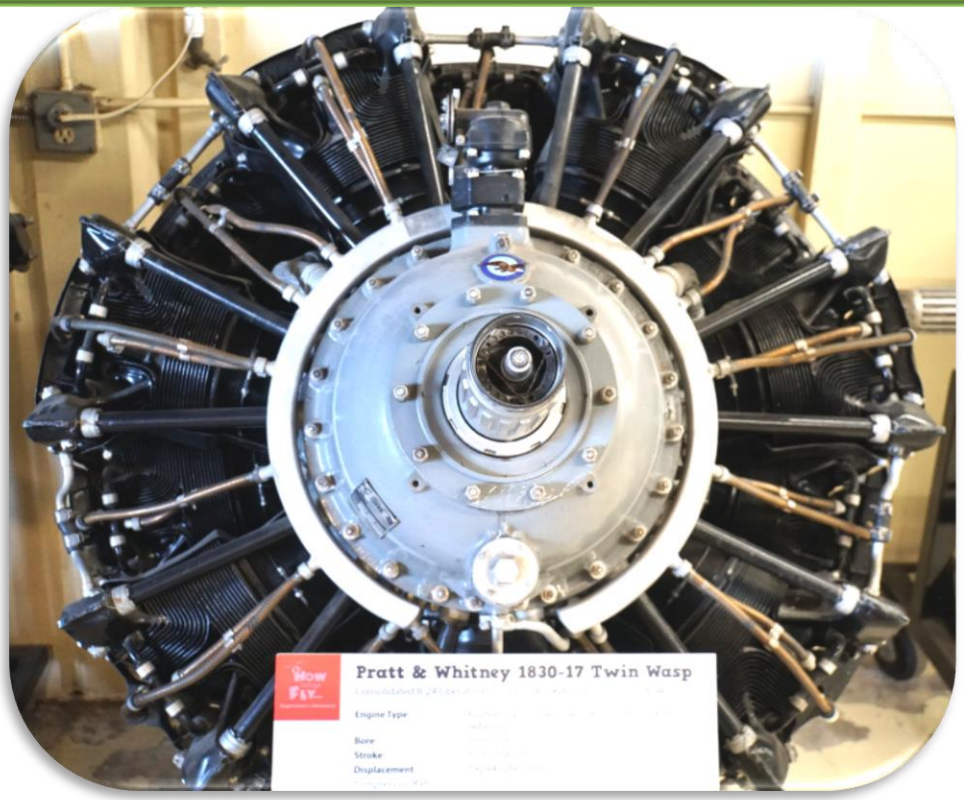
Hangar 1 Engines



1st Run:
1932

More Twin Wasps may have been built than any other aviation piston engine in history.

Key Points: **Pratt & Whitney R-1830 Twin Wasp** (**Original**) is an American aircraft engine widely used in the 1930s and 1940s. Produced by Pratt & Whitney, it is a **two-row, 14-cylinder, air-cooled radial design with seven cylinders on a row**. It displaces 1,830 cu in and its bore and stroke are both 5.5 in . **A total of 173,618 R-1830 engines were built** and from their use in two of the most-produced aircraft ever built, the **four-engine B-24 heavy bomber** and **twin-engine DC-3 transport**; **more Twin Wasps may have been built than any other aviation piston engine in history**. The engine was produced in numerous variants.

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Pratt & Whitney 1830-17 Twin Was

Consolidated B-24 Liberator • Douglas C-47 Skytrain • Grumman F-4F Wildcat

Engine Type	Fourteen-cylinder two-row supercharged air-cooled radial engine
Bore	5.5 in (139.7 mm)
Stroke	5.5 in (139.7 mm)
Displacement	1,829.4 cubic inches (30 l)
Compression Ratio	6.7:1
Power Output	1,200 hp (895 kW) at 2,700 rpm for takeoff, 700 hp (522 kW) at 2,325 rpm cruise power at 13,120 ft (4,000 m)
First Run	1932
Quantity Produced	173,618

B-24

C-47

F-4F

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Hangar 1 Engines

1st Run: 1928

Key Points: **Packard Diesel DR-980** (**Original**) Nine-cylinder air-cooled aircraft diesel engine certificated in 1930. Designed by Lionel Woolson and Professor Hermann Dorner, it was the **world's first practical air-cooled diesel radial aircraft engine**. In May 1931, a Bellanca with a DR-980, set a record for staying aloft for **84 hours and 32 minutes** without refueling. The record held until 1987; broken by the Rutan Voyager. Engine unpopular despite its economy and reliability due to the **unpleasant diesel exhaust fumes and vibration** when running; approximately 100 were built.

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Stinson "Detroiter"

1930
Packard Diesel
DR-980

Ford "Trimotor"

History

The success of the Wright J-5 and the Pratt and Whitney "Wasp" engines motivated the Packard Motor Car Company to commission its chief engineer Capt. Lionel Woolson and German engineer Professor Herman Dohner to design the world's first practical air-cooled diesel radial aircraft engine. The engine, first tested in 1928, received its Department of Commerce Type Certificate in 1930. Diesel engines were used in several aircraft including the Stinson "Detroiter," Verille "Air Coach," and Ford "Trimotor," which could cruise at a fuel cost of three cents a mile. On May 28, 1931, a World's non-refueling duration record was established in a Bellanca "Pacemaker." With a load of 481 gallons of fuel oil on board, the aircraft remained aloft for 84 hours and 32 minutes. This record stood until the Voyager's epic flight of nine days, three minutes, and 44 seconds in December 1986.

Technical Details

A Diesel engine is a compression ignition engine utilizing fuel injection. Fuel is burned more efficiently in a diesel than in any other type of internal combustion engine. However, the design of the engine exhaust gases system caused much discomfort to the pilots and passengers and, unfortunately, the engine was very rough running. Because the air in the cylinders must be compressed to 5000 PSI to reach the temperature of 1000 degrees Fahrenheit necessary to ignite the fuel/air mix when it is injected, great strength is required in the engine parts, which means they must be heavy-walled and of greater weight than is the case with conventional engines. To save weight, magnesium was used for the crankcase. Note the absence of a carburetor, magneto, ignition wires, and spark plugs, which are not needed on a diesel engine. The metal ring at the rear of the engine with its associated cams, torque tubes, and bell-cranks is a part of the fuel injection system.

Type:	9 cylinder, radial, air-cooled	**Dry Weight:**	510 lbs.
Rating:	225 HP @ 1950 RPM	**Ignition:**	Compression ignition
Bore & Stroke:	4.800 in. X 6.000 in.	**Certification Basis:**	A.T.C. No. 43
pression ratio:	16:1	**Manufacturer:**	Packard Motor Company, Detroit, Michigan

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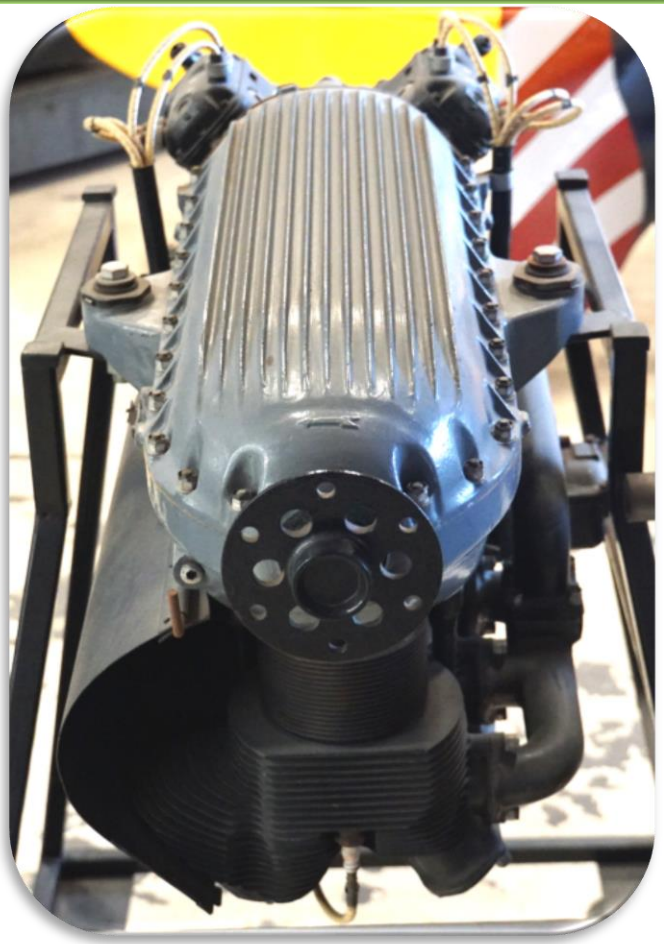
Hangar 1 Engines



1st Run: 1939

Key Points: **ERCO IL-116** (**Original**) Engineering and Research Corporation (ERCO) hired Harold Morehouse, former engineer in charge of small engine design at Continental Motors, to design a new engine. He came up with the inverted, in-line **IL-116**, which **provided good pilot visibility and enhanced aircraft streamlining**. **ERCO manufactured parts for six IL-116s but only three were built.**

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ERCO Model IL-116
(Engineering and Research Company)

The model IL-116 designed in the late 1930's by Harold E. Morehouse for use in the ERCOUPE aircraft. Six were built, of which only two were certified for flight. ERCO engines were used for flight only in the early airframe prototypes. Continental engines were used in all production aircraft.

Type:	Four cylinder in-line, inverted, air-cooled, 4 cycle	Carburetor:	Bendix-Stromberg NA-S2
Displacement:	116 cubic inches	Weight:	158 lbs with propeller
Compression Ratio:	5.75 : 1	Power Rating:	65 hp @ 3,500 RPM
Bore \ Stroke:	3.25in \ 3.5in	Fuel:	73 Octane

Extra Info: **ERCO IL-116** ERCO installed the IL-116 in the prototype Ercoupe Model 310 in 1939. The engine performed well, but ERCO discontinued it when Continental introduced the Continental A65 engine in 1940, which generated comparable horsepower at half the cost. **Only 3 ERCOs were built.**

Back to TOC

Hangar 1 Engines

1st Run:
1930?

Own America's Most Popular Sport Plane!

HERE is a real ship for you! New throughout, but designed and built with Heath's knowledge of *your* needs in a light sport plane.
This splendid new plane has a genuine top speed of 80 M. P. H. and sits down easily and safely at 30 M. P. H. Its stability and visibility make it perfect for novice pilots, while its pep and maneuver ability amaze men of long flying experience.
You can own this fine new Heath in several ways. Buy it ready to fly for $1074 at Niles; assemble it yourself from factory built parts easily for $549, less power plant; or build it from the ground up from Heath's quality blueprints and complete instructions and materials for only $269, less power plant.

HEATH AIRCRAFT CORPORATION
Dept. F-32, Niles, Michigan

Send 15¢ for complete information, including motor prices, terms, etc.

Key Points: **Heath-Henderson B-4** (**Original**) was an **in-line, four-cylinder, air-cooled Henderson motorcycle engine converted for aircraft by modifying the lubrication system and valves.** The B-4 powered the Heath Parasol monoplane, which Heath sold in kit form for homebuilders in the 1920s and '30s. The low-cost, reliable Henderson motorcycle engine was well-suited for the Heath airplane design because it helped make sport flying affordable for many people. Service was simple and economical because parts were cheap and easy to obtain throughout the country.

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Heath B4

In 1925 Ed Heath of Chicago, IL designed a light sport plane called the Heath "Parasol." To make it popular, he realized the cost must be kept low. He did this by converting the Henderson "De Lux" motorcycle engine into the Heath B4 aircraft engine.

Specifications

Type: 4 Cylinder inline aircooled
Rating: 30 HP @ 3000 RPM
Fuel: Auto gas
Fuel Consumption: 1.5 GPH
Bore & Stoke: 2.75 in. X 3.5 in.

Displacement: 83 cu. in.
Compression Ratio: 4.5:1
Weight Dry: 119 lbs including prop.
Carburetor: Zenith-2
Ignition: Single, Spitdorff

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Hangar 1 Engines

Stroke - 4.000 In.
Displacement - 806 Cubic In.
Weight - 590 Pounds (without accessories)
Applications:
APU on YB-49 (Northrop jet flying wing)
Powerplant on XBQ-5 (Interstate aircraft and engineering

1st Run: c. 1945

Key Points: **The Franklin XO-805** (**Original**)(company designation 12AC) was an American air-cooled aircraft piston engine, **designed in the mid-1940s and was to be used in radio-controlled pilotless drones** that were to be guided from an accompanying control plane. Due to project requirement changes and cancellations the engine was not produced in quantity. A smaller displacement 12-cylinder Franklin engine of 1941 was known as the O-595 or 12AC-596.

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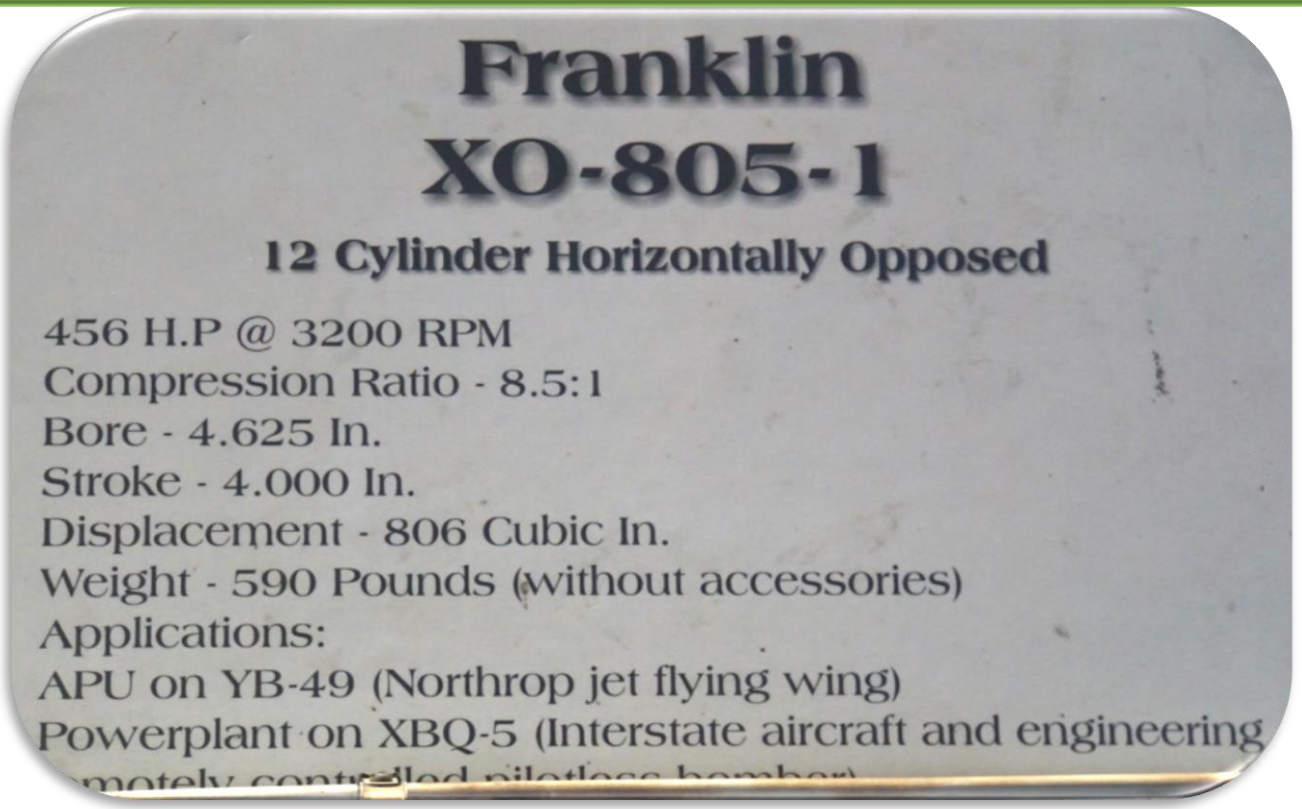
Franklin
XO-805-1
12 Cylinder Horizontally Opposed
456 H.P @ 3200 RPM
Compression Ratio - 8.5:1
Bore - 4.625 In.
Stroke - 4.000 In.
Displacement - 806 Cubic In.
Weight - 590 Pounds (without accessories)
Applications:
APU on YB-49 (Northrop jet flying wing)
Powerplant on XBQ-5 (Interstate aircraft and engineering

Extra Info: **Franklin XO-805 used as APU on the Northrop YB-49.** The YB-49 was a prototype jet-powered heavy bomber developed by Northrop after World War II. The YB-49 featured a flying wing design. The YB-49 never entered production, being passed over in favor of the more conventional Convair B-36 piston-driven design. Design work performed on the YB-49 proved valuable to Northrop decades later in the development of the B-2 stealth bomber, which entered service in the early 1990s.

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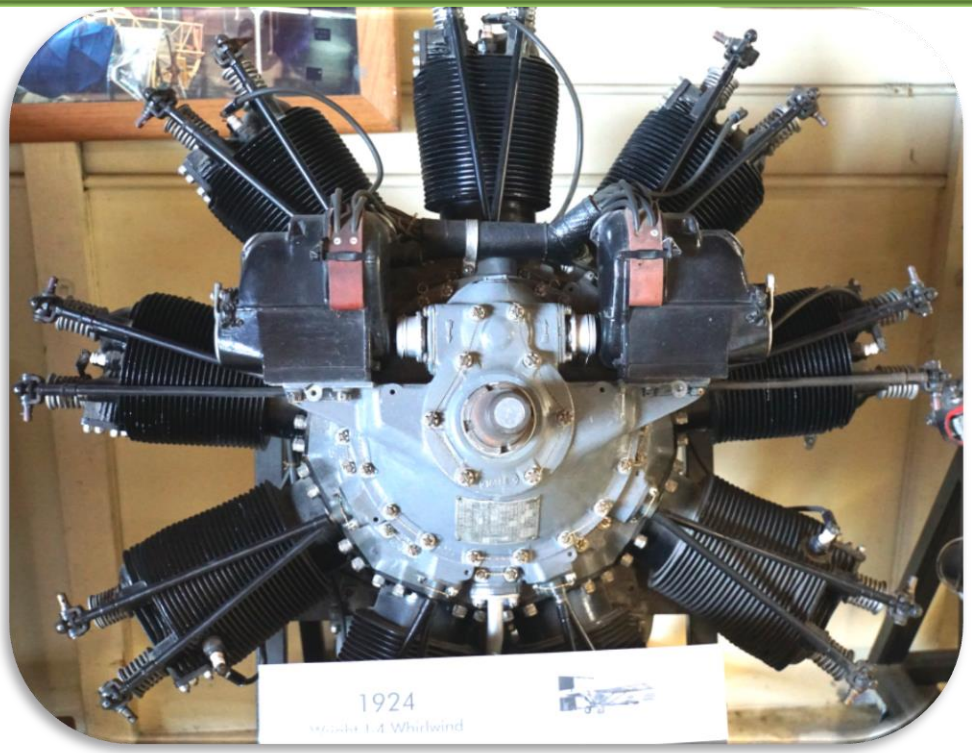
Hangar 1 Engines



1st Run: 1923

Key Points: **Wright J-4 Whirlwind** (**Original**) was in the R-790 series engine which included the J-1 thru J-6. **R-790 began as a Lawrance J-1**, a nine-cylinder air-cooled radial developed in 1921 by the Lawrance Aero Engine Company for the U.S. Navy. **Wright purchased Lawrance and the Lawrance J-1 became the Wright J-1.** Wright gradually refined the J-1 engine, introducing the J-3, J-4, J-4A, and J-4B. The changes improved the engine's reliability, cooling, and fuel consumption, but the basic design, dimensions, and performance were unaltered. **The J-4 was the first engine to bear the Whirlwind name.**

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1924
Wright J-4 Whirlwind

Ryan M-1 Mail Plane

History

The J-4 Whirlwind was the first successful air-cooled stationary radial built in the US and was the predecessor of the famed J-5 that powered Lindbergh's historic transatlantic flight. In 1923 the US Navy pressured the Wright Aeronautical Corp. to buy out a small firm owned by Charles L. Lawrence that had been developing a promising air-cooled 200 horsepower radial engine. Lawrence's 9-cylinder J-2 radial was further developed by Wright and was introduced as the J-4 Whirlwind in 1924. It was used in a number of civil and military aircraft, most notably in the Ryan M-1 Mail Plane.

Technical Details

The Wright J-4 had cast aluminum cylinder barrels with integral cooling fins and steel cylinder sleeves. The aluminum heads had two pushrod operated valves per cylinder with exposed valve gear. There were two plugs per cylinder fired by reliable Scintilla magnetos. An updraft Stromberg carburetor supplied mixture to the cylinders via pipes without the aid of a blower or supercharger. The crankshaft and master-and-link connecting rods were sturdy enough to allow for additional development. In 1926 the J-4 became the J-5 model with the addition of new cylinder heads designed with the help of Sam Heron of the Army's powerplant lab in Dayton, Ohio. The new head design had much deeper cooling fins, enclosed valve gear and sodium-cooled exhaust valves set at a wide angle to the inlet valves for better cooling airflow. Both reliability and fuel consumption were greatly improved and the Whirlwind became known as the most reliable aircraft engine built up to that time.

Type:	9-cylinder single-row stationary radial; air-cooled	Induction System:	Updraft Stromberg carburetor
Displacement:	788 cubic inches	Weight:	470 pounds
Compression Ratio:	5.3 : 1	Power Rating:	220 hp at sea level, 1800 RPM
Valve Arrangement:	Two pushrod-operated valves per	Fuel Consumption:	Approx. 0.5 lb/hr per hp

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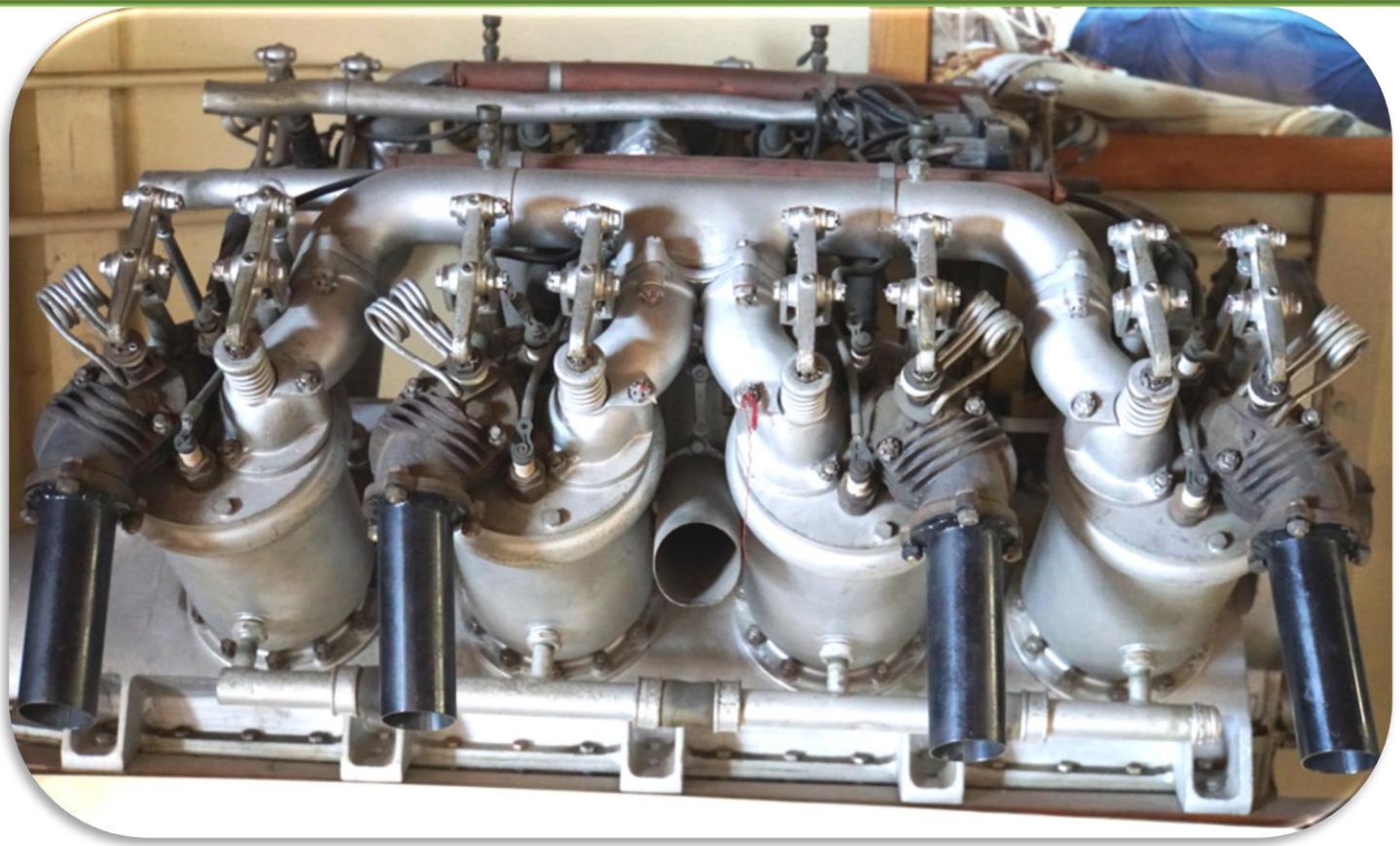

1st Run: 1916

Key Points: **Curtiss Model V2 Type 3** (**Original**) The **follow-on engine to the OX series**. 1916/17 **Curtiss produced R-4 airplanes for the Army, some of which were used during Pershing's 1916 Mexican Punitive Expedition**. The **V2-3 engine, rated at 200 hp, powered the R-4**, however it had a poor power to weight ratio which hurt performance. Also used on early twin engine flying boats in 1917. R-4's later refitted with the Liberty L-12 engine.

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CURTISS MODEL V2 TYPE 3

This eight cylinder, 200 hp engine was a follow-on to the earlier Curtiss OX series engines. Although not particularly significant from an engineering standpoint, nevertheless, the V2-3 did see limited service prior to WW I as the power plant for the Curtiss R-4 airplane. A total of fifty-five of these planes were sold to the U.S. Army for approximately $14,000 each and a few of them saw service with the Mexican Punitive Expedition of 1916 lead by General John J. Pershing. V2-3 engines were also installed on the Navy's early twin-engine flying-boats that were produced by Glenn Curtiss in 1917 shortly after the United States entered WW I.

SPECIFICATIONS

Powerplant	200 h.p.
Type	90° V
Cylinders	Eight
RPM	200 h.p. at 1400 r.p.m.
Gross weight	924 lbs.
Bore and Stroke	5 in. x 7 in.
Weight per h.p.	4.04 lbs.
Fuel per hour	122 lbs.
Oil per hour	7.7 lbs.
Ignition	2 eight-point magnetos

Manufacturer ..... Glenn Curtiss Co., Buffalo, NY

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One of a series of engines starting with Eddie Rickenbacker's **Detroit Aircraft Company's** original *Aircat* engines. Includes the ***Velie,*** *LeBlond, Lambert & Ken Royce* engines.

1st Run: 1914

Key Points: **Velie M-5** (**Original**) Eddie Rickenbacker's Detroit Aircraft Co's **AIRCAT** engines powered the first Monocoupe airplanes. Willard Velie purchased Monocoupe, copied the AIRCAT engine and produced the **Velie** engine and later **LAMBERT**. Also the **Le Blond** Aircraft Machine Tool Co., purchased Detroit Aircraft & patents then produced a copy of the **AIRCAT** engine and called them **Le Blond** & **Ken Royce** engines. **This:** 250.6 cu. In., for 65 hp.

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1928 Velie M-5

The first production airplanes produced by Monocoupe were powered by Detroit AIRCAT engines. This engine company was started by Captain Eddie Rickenbacker. Although the AIRCAT powered Monocoupe was selling well, the engine company got into financial difficulties and had to close. Don Luscombe, president of the Monocoupe company then approach Willard Velie, a pioneer coach and automobile manufacturer, and asked him to build an airplane engine in the Velie auto engine plant. Velie not only agreed to do this, but he also purchased the Monocoupe company in the process.

To get engines rapidly, Velie decided to copy the AIRCAT engine. It only required a few changes to adapt and design to fit his foundry and machine shop equipment. Shortly thereafter, Velie changed the aircraft engine plant's name to LAMBERT.

In the meantime, the Le Blond Aircraft Machine Tool Company purchased the assets of the Detroit Aircraft Company including its patents. They then started producing Rickenbacker's engine under the Le Blond name. They also required Lambert to pay them patent royalties.

Later, R. A. Rearwin purchased the Le Blond Aircraft Engine Company that was a subsidiary of the parent Le Blond Machine Tool Company. Rearwin then started producing the engine under the names of his two sons, Ken and Royce, and the engine became know as the Ken Royce.

This is why AIRCAT, VELIE, LAMBERT, LE BLOND and KEN ROYCE engines are all so similar.

SPECIFICATIONS

TYPE - Five Cylinder radial, air cooled
RATING - 65 HP @ 1,900 RPM
FUEL - 79 minimum octane aviation gas
DISPLACEMENT - 250.6 cu. in.
BORE & STROKE - 4.125 X 3.750 in.
COMPRESSION RATIO - 5.4:1
WEIGHT DRY - 234 lbs
IGNITION - Dual Scintilla PN5-D magnetos
CERTIFICATION - Type Certificate No. 4

Manufacturer - Velie Motors Corporation

Donated by Jack Nees, Palm Springs, California
1994

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Hangar 1 Engines

1st Run: 1914

Key Points: **Thomas-Morse Model 8** (**Original**) **V-8 Cylinder 135 shp** was built by the Thomas Aeromotor Company, later known as Thomas-Morse Aircraft Corporation, Ithaca, New York. After 1912, the company confined its efforts entirely to 8-cylinder water-cooled V-types. The Thomas-Morse Model 8 engine was fitted with reduction gears to reduce propeller speed to 1,200 rpm. **It's most unique feature was being the first aircraft engine to be equipped with a self-starter; the Christensen self starter.** It powered aircraft such as the Thomas D-5.

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THOMAS 8

In 1915, the Thomas Bros. purchased the design and production rights of the 1914 Sturtevant 5. They called their modified and improved version the Thomas 8. It was intended to replace the Curtiss OX-5 in training planes. However, it proved to be too heavy for the power produced, so only a few were built. In 1917, Thomas Bros. merged with the Morse Chain Company. The Thomas-Morse Aircraft Corporation then manufactured both engines and planes for the fledgling Army and Navy air services.

The most unique feature of this engine is the use of the "Christensen" self starter. An engine driven air pump supplies compressed air to a storage tank. When a control valve is opened, air from the tank flows through a special carburetor which mixes gasoline with the air. It then goes to an air distributor whose function is similar to an ignition distributor. It routes the explosive mixture into each cylinder in the proper firing order. As the compressed air-gas mixture flows into a cylinder, it will move the piston down just as an explosion would. A check valve on top of each cylinder prevents backflow on the compression stroke. The piston moving down starts the engine rotating. After a few pulses, a charge will fire and the engine will continue to run. The air pump then replenishes the air in the tank for the next start.

SPECIFICATIONS

Type: 8 cylinder vee, water cooled
Rating: 135 H.P. @ 2000 crankshaft R.P.M.
Propeller Drive Gear Ratio: 21:12
Fuel Consumption: 14 gallons per hour
Bore & Stroke: 4 in. x 5.5 in.
Displacement: 552.9 cu. in.

Cylinders: cast iron, in pairs
Heads: detachable "L" type with central valve gear
Weight Dry: 550 lbs. complete with starter
Carburetion: 2 in. Duplex Zenith
Ignition: dual, Splitdorph "Dixie 8"

Manufacturer: Thomas Aeromotor Company, Inc. Ithaca, New York

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Hangar 2

Key Points: Hangar 2 was donated, refurbished and relocated from Kearny Mesa to Gillespie Annex by The General Dynamics Corporation in **1997**, and is dedicated to the members of the Convair Alumni Association and GDC employees.

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Hangar 2

This building, originally located at an aerospace manufacturing plant in Kearny Mesa, was donated by
THE GENERAL DYNAMICS CORPORATION
To
THE SAN DIEGO AEROSPACE MUSEUM
with a generous grant to assist with its refurbishment and relocation to the museum's Gillespie Field Annex.
It is dedicated, in part, to members of
THE CONVAIR ALUMNI ASSOCIATION
and to other GDC employees who were instrumental in the transfer of ownership.
Dedicated October, 1997

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Hangar 2

Key Points: **Welding Shop.** Hangar 2, one of several shops for the fabrication and/or repair of aircraft, artifacts, assemblies or components. Showing many of the tools, hardware and supplies used to **cut and weld metal during construction, repair or restoration**. Capable of **gas, arc, MIG and TIG welding as well as brazing and soldering**.

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Hangar 2

Key Points: **Machine Shop.** Hangar 2, one of several shops for the **fabrication and/or repair of aircraft, artifacts, assemblies or components**. Showing many of the tools, hardware and supplies used to **cut, drill, turn and mill metal during construction, repair or restoration.**

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Hangar 2

Key Points: **Restoration/Construction Area.** Hangar 2, one of many areas for **layout, cleaning, repair or construction of aircraft, artifacts, assemblies or components**. Shown awaiting new project with extra sheet metal brake and shear on right, work stands/ladders on left.

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Hangar 2

Key Points: **Sheet Metal Shop.** Hangar 2, one of several shops for the **fabrication and/or repair of aircraft, artifacts, assemblies or components.** Showing many of the tools, raw stock, hardware and supplies used to **cut, bend, burnish and mold sheet metal during construction, repair or restoration.**

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Hangar 2

Key Points: **Restoration/Construction Area.** Hangar 2, one of many areas for **layout, cleaning, repair or construction of aircraft, artifacts, assemblies or components.** Showing many of the tools, metal stock, hardware and supplies used during construction, repair or restoration.

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Hangar 2

Key Points: **Restoration/Construction Area.** Hangar 2, one of many areas for layout, cleaning, repair or construction of aircraft, artifacts, assemblies or components. Shown with a **wing being recovered**.

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Hangar 2

Key Points: **Restoration/Construction Area.** Hangar 2, one of many areas for layout, cleaning, repair or construction of aircraft, artifacts, assemblies or components. Shown with the **Aeronca L-3B Grasshopper wings being recovered**.

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Hangar 2

Key Points: **Restoration/Construction Area,** Hangar 2, one of several areas for layout, cleaning, repair or construction of aircraft, assemblies or components. Shown with an **Aeronca L-3B Grasshopper fuselage being restored**.

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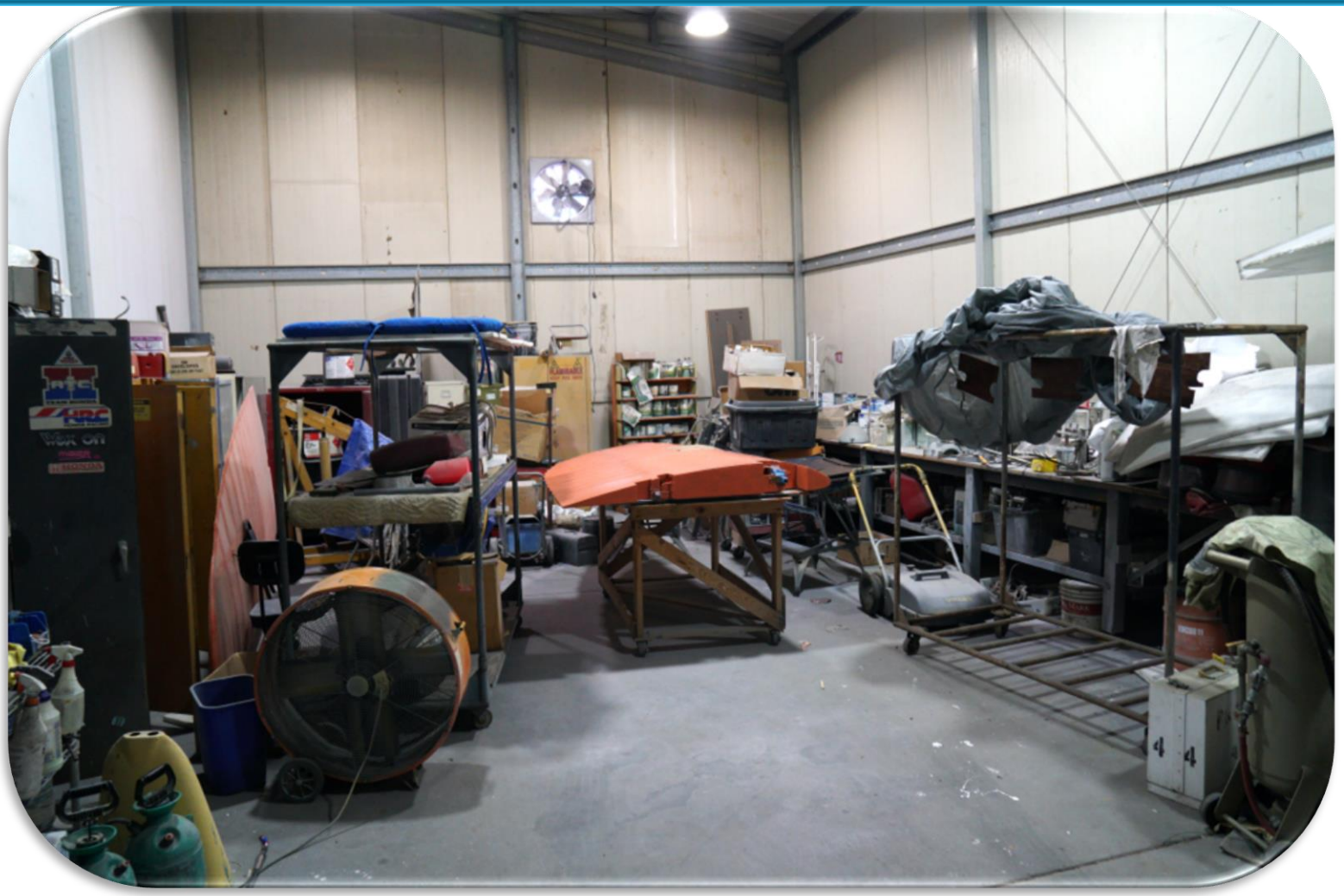
Hangar 2



Key Points: **Paint Shop,** at the Southeast end of Hangar 2 provides a safe environment for the **protective, restorative and finish painting** of both new reproduction aircraft and historical artifacts from either the **Balboa Park or Gillespie fabrication/restoration shops**.

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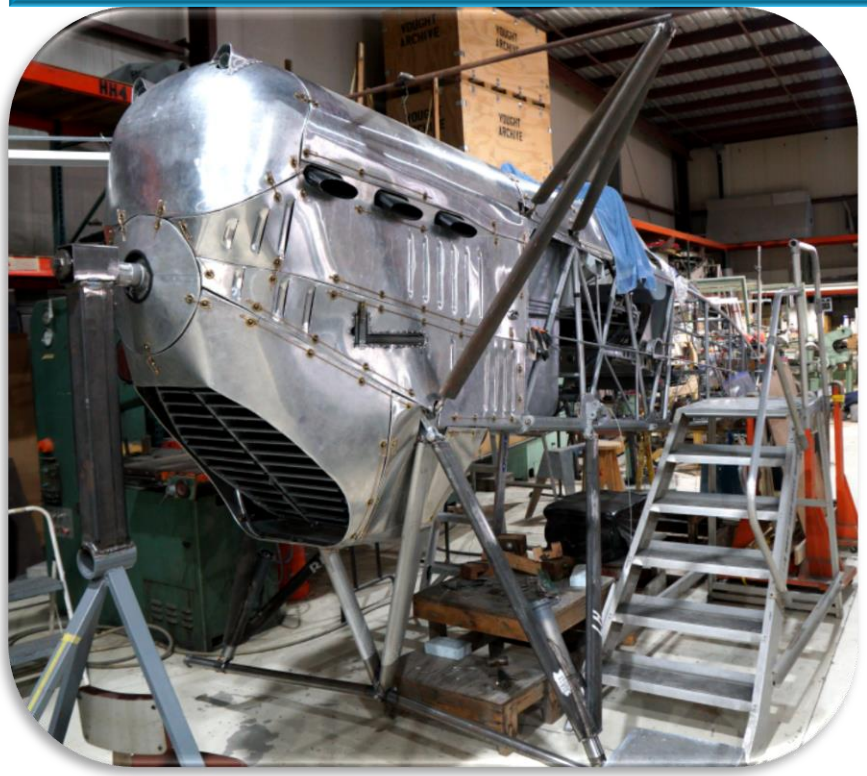
Hangar 2



1st flight:
1926

Key Points: Boeing FB-5 (Reproduction with **original parts**) **Designed for aircraft carrier service** with heavy undercarriage for high impact landings. 27 built and delivered to the Navy (January 21, 1927) on board USS Langley. Satisfactory shipboard performance, but Navy switched to air cooled radial engines for shipboard aircraft; FB-5's retired after two years service. **Two aircraft in existence; #1 at the National Air and Space Museum and #2 is here at SDASM**.

This: On loan from George Rice. Restored with parts from two other FB-5s, one of which flew off the US Navy's first aircraft carrier, USS Langley, based in San Diego in the 1920s.

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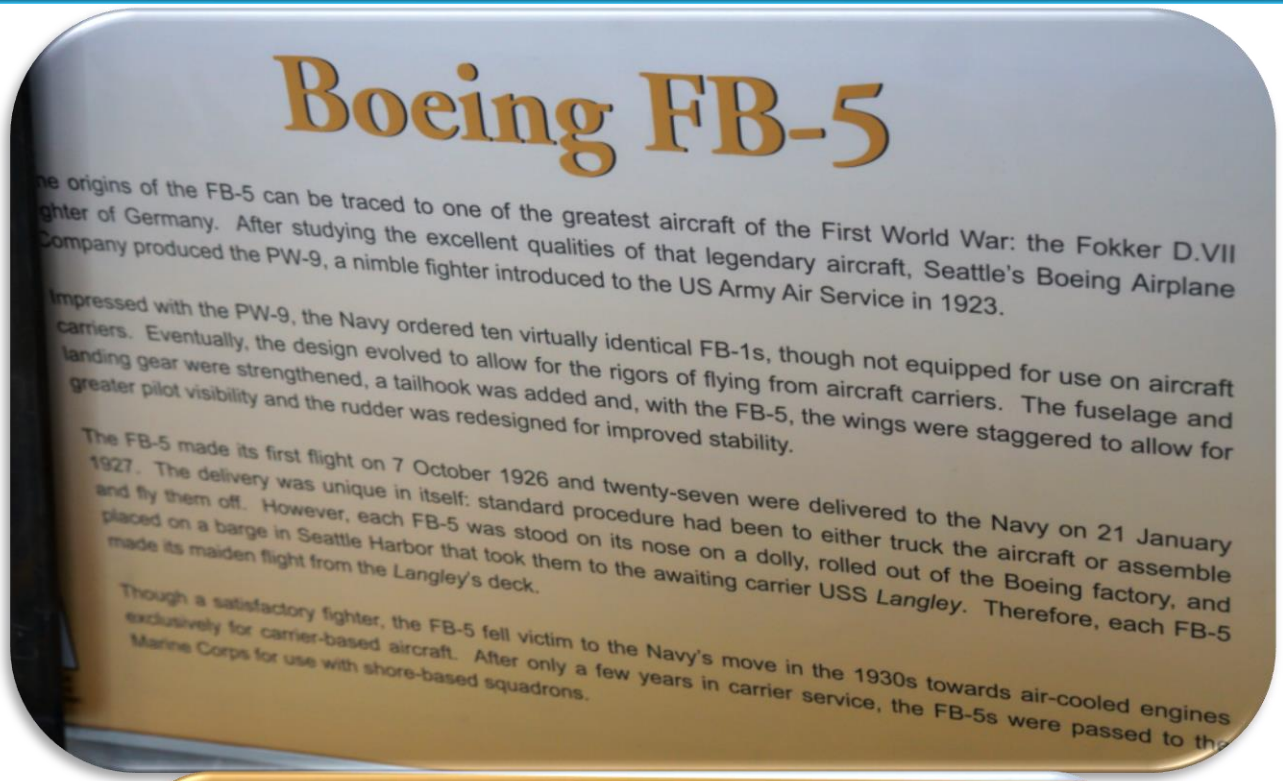

Boeing FB-5

he origins of the FB-5 can be traced to one of the greatest aircraft of the First World War: the Fokker D.VII ghter of Germany. After studying the excellent qualities of that legendary aircraft, Seattle's Boeing Airplane Company produced the PW-9, a nimble fighter introduced to the US Army Air Service in 1923.

Impressed with the PW-9, the Navy ordered ten virtually identical FB-1s, though not equipped for use on aircraft carriers. Eventually, the design evolved to allow for the rigors of flying from aircraft carriers. The fuselage and landing gear were strengthened, a tailhook was added and, with the FB-5, the wings were staggered to allow for greater pilot visibility and the rudder was redesigned for improved stability.

The FB-5 made its first flight on 7 October 1926 and twenty-seven were delivered to the Navy on 21 January 1927. The delivery was unique in itself: standard procedure had been to either truck the aircraft or assemble and fly them off. However, each FB-5 was stood on its nose on a dolly, rolled out of the Boeing factory, and placed on a barge in Seattle Harbor that took them to the awaiting carrier USS *Langley*. Therefore, each FB-5 made its maiden flight from the *Langley*'s deck.

Though a satisfactory fighter, the FB-5 fell victim to the Navy's move in the 1930s towards air-cooled engines exclusively for carrier-based aircraft. After only a few years in carrier service, the FB-5s were passed to th Marine Corps for use with shore-based squadrons.

SPECIFICATIONS

MANUFACTURER	*Boeing Airplane Company, Seattle, WA*
TYPE	*Carrier-based fighter*
ENGINE	*Packard 2A-1500, 520 hp at 2,100 rpm*
WINGSPAN	*32 ft (9.75 m)*
LENGTH	*23 ft 10 in (7.26 m)*
HEIGHT	*9 ft 5 in (2.87m)*
GROSS WEIGHT	*3,249 lbs (1,474 kg)*
MAXIMUM SPEED	*175 mph (281 km/h)*
RANGE	*420 miles (675.9 km)*
CEILING	*22,000 ft (6,705.6 m)*
ARMAMENT	*One 30-cal. machine gun, one 50-cal. machine gun*
CREW	*One*

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Hangar 2

1st flight:
1952

Key Points: **Piasecki H-21 Workhorse/Shawnee** (**Original**) is a tandem rotor helicopters by Piasecki Helicopter (later Boeing Vertol). Called "the flying banana", it was **a multi-mission helicopter, utilizing wheels, skis, or floats.** Originally developed as an Arctic rescue helicopter, could operate and be maintained at −65 °F (−54 °C). Powered by one nine-cylinder Curtis-Wright R-1820-103 Cyclone supercharged 1,150 hp air-cooled radial engine. At least 185 produced.

This: **Landed inside the Vatican, Feb 15, 1959, first motorized vehicle to ever enter the inner compound, was blessed by Pope John XXIII, in connection with rescue work during the 1959 Italian earthquake disaster. Afterwards, said that the radio call sign used in Europe was "Holy One".**

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General characteristics

Crew: 3–5 (Pilot, co-pilot, crew chief and one or two gunners in Vietnam)
Capacity: 20 troops *or* 12 stretchers
Length: 52 ft 6 in
Rotor diameter: 44 ft 0 in
Height: 15 ft 9 in
Empty weight: 8,950 lb
Max. takeoff weight: 15,200 lb
Powerplant: 1 × Wright R-1820-103 radial engine, 1,150 hp driving 2 rotors

Performance

Maximum speed: 127 mph (110 knots)
Cruise speed: 98 mph (85 knots)
Range: 265 mi (230 nm)
Service ceiling: 9,450 ft

Back to TOC

Hangar 2

1st flight: 1952

Key Points: **Beecraft Honey Bee** (**Original**) A **single seat, all-metal high-wing, tricycle gear-equipped aircraft with a V-tail**. **Homebuilt** aircraft designed and built by Ken Coward and former SDASM President William F. Chana. First flown on 12 July 1952. The stressed skin aircraft is designed to accommodate wing flaps and slots. Was test flown by William Chana on 12 July 1952 and certified on 17 December 1953 (**Making it the first FAA approved aircraft in the second half of the first century of powered flight**).

This: Only aircraft produced by Bee Aviation. **Believed to be first homebuilt aircraft certified by the FAA**. Donated to SDASM by EAA, Oct, 2004.

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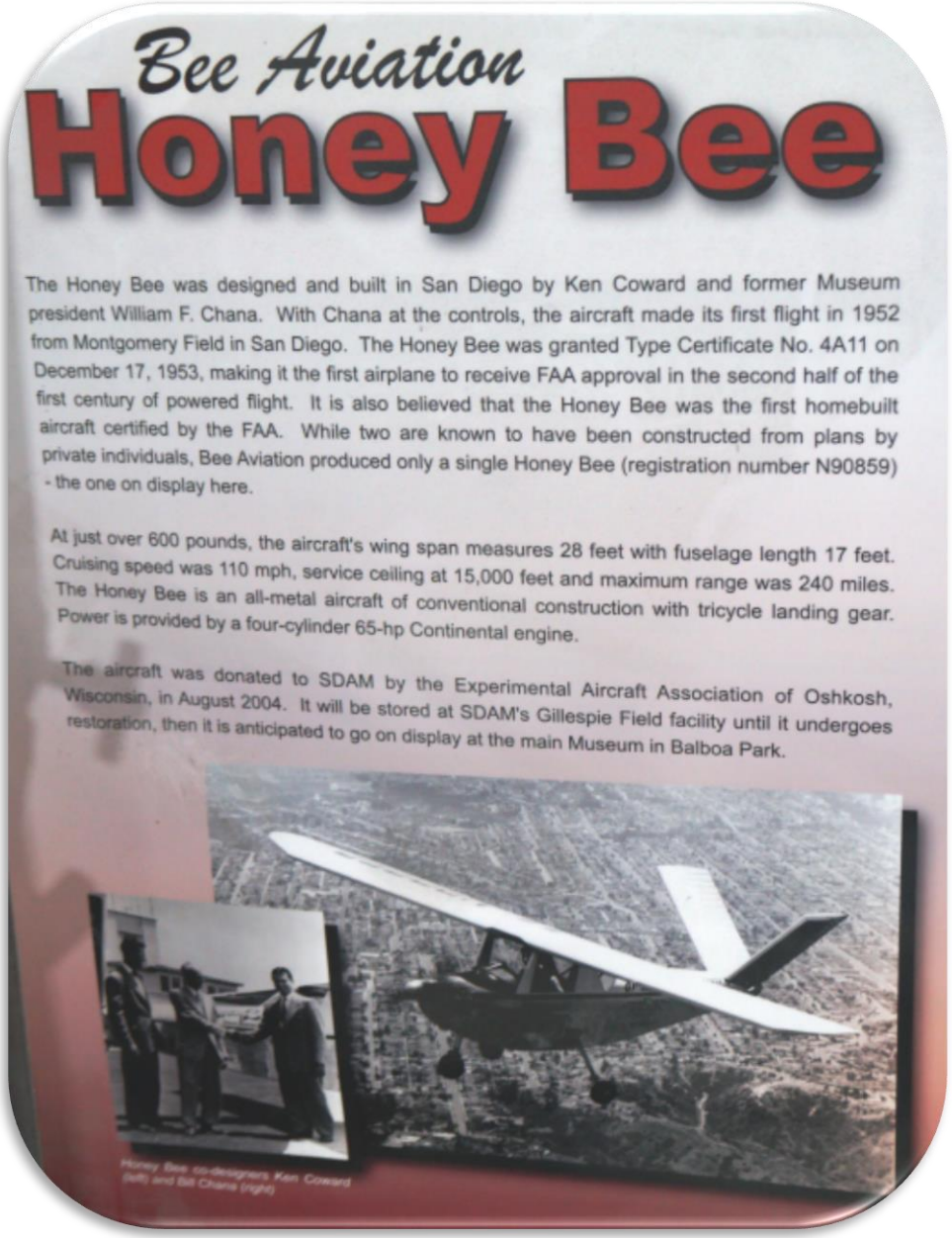
Bee Aviation
Honey Bee
The Honey Bee was designed and built in San Diego by Ken Coward and former Museum president William F. Chana. With Chana at the controls, the aircraft made its first flight in 1952 from Montgomery Field in San Diego. The Honey Bee was granted Type Certificate No. 4A11 on December 17, 1953, making it the first airplane to receive FAA approval in the second half of the first century of powered flight. It is also believed that the Honey Bee was the first homebuilt aircraft certified by the FAA. While two are known to have been constructed from plans by private individuals, Bee Aviation produced only a single Honey Bee (registration number N90859) - the one on display here.
At just over 600 pounds, the aircraft's wing span measures 28 feet with fuselage length 17 feet. Cruising speed was 110 mph, service ceiling at 15,000 feet and maximum range was 240 miles. The Honey Bee is an all-metal aircraft of conventional construction with tricycle landing gear. Power is provided by a four-cylinder 65-hp Continental engine.
The aircraft was donated to SDAM by the Experimental Aircraft Association of Oshkosh, Wisconsin, in August 2004. It will be stored at SDAM's Gillespie Field facility until it undergoes restoration, then it is anticipated to go on display at the main Museum in Balboa Park.

General characteristics

Crew: 1
Length: 17 ft
Wingspan: 29 ft
Empty weight: 550 lb
Gross weight: 860 lb
Powerplant: Continental A-65 , 65 hp
Propellers: 2-bladed

Performance

Maximum speed: 100 kn (120 mph)
Service Ceiling: 15,000 ft
Rate of climb: 1,100 ft/min
Max Range: 240 miles

Back to TOC

1st flight:
1947

On display in the Pavilion at Balboa Park

Key Points: **Custom Built International Formula 1 Midget Racer "Shoestring".** (**Original**) **Flew more races and had more victories than any racer in any class of racing**. 105 race entries from 1949 until 1981; **51, 1st place finishes**, set national speed record (1981) of 254.3 mph. Fourth owner, Ray Cote & family of El Cajon, raced Shoestring from 1966 until 1981, **won 40 out of 64 races** entered, including **9 National Championship titles**.
This: Donated by the Cote family to SDASM in 1982.

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On display in the Pavilion at Balboa Park

Extra Info: Shoestring was built in 1947 at Van Nuys Airport by Carl & Vince Ast, helped by Bill Catlin, and Harry Gann. Designed by Rodney Kreimendahl. Powered by Continental C85 85 hp engine, it has a weight of 565 lbs, length of 17’ 8”, width of 19’ and height of 4’ 8”. With the help of Carl Ast and Paul Jones, **Cote began an extensive two-year modification program to improve its design and aerodynamics; this culminated in the first of his eight consecutive “Shoestring” national championships in 1968**. Cote donated Shoestring to the San Diego Air & Space Museum in 1981, after it had won its ninth national championship earlier that year.

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1st flight: 1995

Key Points: **"Miss B. Haven"** (**Original**) Constructed as a Monnett Sonerai II, that was originally called *Shadow*. It was built using the fuselage molds originally built for *Nemesis*. Dan bought the molds from Jon Sharp. Dan (?) used a much more conventional thin wing profile on *Shadow*, and always felt that had been a mistake, as it never came close to Nemesis performance under Dan or Charlie. It was a solid Gold Race airplane, but never really close to winning. The airplane project which became Fraed, not was a direct result of Dan's experience with Shadow, but was a completely new design, with nothing in common with Shadow.

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1st flight: 1995

Key Points: Charlie Greer with his Gilbert DG-1 #69 "Miss B. Haven " N169MB. Like the *Shoestring* of George Budde, this is also a modern F-1 Racer made of composite building materials. Thus there are **more flowing design forms possible compared to the wooden Cassutt Racers.** Built in 1995, single engine, single seat, experimental. **Continental engine, C90 Series, 95 hp.**

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1st flight: 1974

Key Points: **Williams-Cangie WC-1 "Sundancer"** (**Original**) N1AE, S/N 1, Homebuilt racing biplane designed by Art Williams & Carl Cangie. Built by Ralph Thenhaus in 1974. Only one was built. Features unusual biplane layout, upper wing just below the cockpit canopy and the lower gull wing mounted at the bottom of the fuselage. Single-seat enclosed cockpit with a bubble canopy & fixed conventional landing gear. Fuselage was derived from the Bushby Midget Mustang. Aircraft made from aluminum sheet, with flush riveted stressed skin. **On its first flight the WC-1 set a national class record of 194 mph**. **Was 6 times National Champion and World Record holder.**

This: Donated by Pat Hines of Encino, CA, and put on display 1987.

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SUNDANCER
One of Air Racing's more famous planes—Sundancer—was six times National Champion and World Record Holder. During its racing years, Sundancer had two different owners/pilots.
The Sundancer project was started by Dr. Sidney G. White, M.D. in 1969. In 1973 and again in 1974, with then owner and pilot Sid White at the controls, Sundancer beat all competition in its racing bi-plane class, attaining a top closed-course speed record of 198.17 mph at the Reno Air-Races in 1974. At that time, Sundancer had a 135 H.P. engine installed.
The new owner, Pat Hines, continued Sundancer's winning tradition by winning first at Reno from 1980 to
speed record for this class of 224.9
In December 1986, Pat Hines of Encino, California donated this historic racer to the Museum, and it was placed on display in March 1987.

On display in the Pavilion at Balboa Park

General characteristics

Crew: one
Length: 16 ft 1 in
Upper wingspan: 19 ft 9 in
Empty weight: 835 lb
Gross weight: 1,115 lb
Useful load: 280 lb
Fuel capacity: 16 U.S. gallons
Engine: Lycoming O-290-D2, 135 hp
Propeller: 2-bladed metal

Performance

Maximum speed: 235 mph (204 kn)
Stall speed: 65 mph (56 kn)

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Hangar 2

1st flight: 1928

Key Points: **Curtiss B-1 Robin** (Original) introduced in 1928, was a high-wing monoplane built by the Curtiss-Robertson Airplane Manufacturing Company. **The C-1 (or J-1) version was flown by Douglas "Wrong Way" Corrigan who crossed the Atlantic (New York to Ireland) in 1938, mimicking Lindberg's 1927 flight.** The Robin had a wooden wing and fabric covered steel tubing fuselage. Initially powered by the 90 hp Curtis OX-5 engine, later versions used the Wright J-6-5 Whirlwind. The cabin accommodated three persons; two passengers were seated side-by-side behind the pilot. **769 Robin's were built**.

This: Built 1929, as **B-1 with OX-5 engine**. **Very rare, only a few still exist**. Acquired from Johan Larsen in 1978 with grants from Parker & Gildred Foundations.

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Curtiss B-1 "Robin"

In1927, with Charles Lindbergh's record-breaking solo trans-Atlantic flight, a new fascination with flying quickly took over the public, and an ever increasing number people yearned to fly their own airplane. The Curtiss Aeroplane and Motor Company of Garden City, New York saw this as a great opportunity to offer an affordable, durable, and easy to fly airplane for sale to the general public. Curtiss formed the Curtiss-Robertson Airplane Manufacturing Company in association with Robertson Aircraft Corporation in St. Louis, Missouri, and by 1928 the company began production of the B-1 Robin. The initial price tag was just under 4,000 dollars.

This high wing, enclosed cockpit monoplane incorporated the most reliable design concepts with the least expensive materials available at the time. The fuselage was constructed of fabric-covered steel tubing, while externally braced wings were constructed of wood spars and stamped aluminum ribs. Initially the Robin used the highly reliable and inexpensive surplus Curtis OX-5, the legendary engine used in the JN-4 Jenny. Later versions offered more powerful Challenger six cylinder and Wright J-6-5 Whirlwind engines, and were designated C-1 and J-1 respectively.

Promoted through an extensive advertising campaign, highlighting the safety and durability of the aircraft, the Robin quickly became very popular. By 1929 the Curtiss-Robertson Company was producing 17 per week to keep up with the demand. In all, 769 Robins were built (300 of which were B-1s), making it one of the most numerous civilian aircraft of its day. During the thirties Robins were a common sight at airports across the country. Perhaps the most well known Robin was a C-1 flown by Douglas "Wrong Way" Corrrigan in 1938 from New York to Ireland.

The museums aircraft, serial number 329, was built in 1929. It is very rare version, being one of only one a few OX-5 equipped B-1s still in existence. It was restored between 1969 and 1972 by the owner, Jack Lysdale of St Paul, Minnesota. It was acquired by the Museum from Johan M. Larsen in 1978. The restoration was sponsored by grants from the Parker and Gildred Foundations.

Curtiss ROBIN

Manufacturer:	Curtiss-Robertson Airplane Manufacturing Company, St. Louis Missouri
Type:	3-Place Monoplane
Engine:	One 90 hp liquid-cooled Curtiss OX-5
Wingspan:	41 ft 0 in (12.5 m)
Length:	25 ft 9 in (7.85 m)
Height:	7 ft 10 in (2.4 m)
Gross Weight:	2175 lbs (988 kg)
Max Speed:	100 mph (160 km/h)
Ceiling:	12,500 ft (3710 m)
Crew:	One pilot and two passengers

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1st flight: 1935

Key Points: **Taylor Aircraft J-2 Cub** (**Original**)(later also known as the **Piper J-2 Cub**) is an American two-seat light aircraft that was designed by Walter Jamouneau and Clarence Taylor and built by the Taylor Aircraft Company. The company became the Piper Aircraft Company and the **J-2 was first of a long line of related Piper Cub designs**.

Powered by a 37 hp Continental A-40-3 piston engine the aircraft appeared in October 1935 and the type certificate was issued on 14 February 1936. **Over 1200 built**.

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Hangar 2

General characteristics

Crew: 2
Length: 22 ft 5 in
Wingspan: 35 ft 2 ½ in
Height: 6 ft 8 in
Empty weight: 563 lb
Gross weight: 970 lb
Fuel capacity: 9 US gal
Powerplant: 1 × Continental A-40-3 air-cooled flat-four, 37 hp

Performance

Maximum speed: 87 mph (76 kn)
Cruise speed: 70 mph (61 kn)
Range: 210 mi (180 nmi)
Service ceiling: 12,000 ft
Rate of climb: 450 ft/min

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Hangar 2

1st flight: 1971

Key Points: **Sonex Light Sport Aircraft** (**Original**) The **Sonex**, **Waiex** and **Xenos** are a family of lightweight, metal, low-wing, **two seat homebuilt aircraft**. Kits are produced and marketed by Sonex Aircraft (founder, John Monnett) , a small manufacturer based in Oshkosh, Wisconsin. **500 customer built aircraft have been completed by 2014**. The Sonex can also be built from plans.

This: Donated to the Museum by Ted Gildred II

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sonex

LIGHT SPORT AIRCRAFT

The Sonex is an example of an amateur built light sport aircraft. Built conventionally with aluminum and rivet construction, it weighs in at 1,150 pounds.

This Sonex was donated to the Museum by Ted Gildred II

SONEX SPECIFICATIONS

Aircraft Type	Sonex
Serial Number	086
Engine	Jabiru 3300
Horsepower	120
Cruise Speed	170 MPH @ 7,000 ft.
Gross Weight	1,150 lbs.
Wing Span	22 ft.
Wing Area	98 sq. ft.
Fuel Capacity	16 gal.
Range	400 mi.

Extra Info: Built around a Jabiru or VW engine with all-aluminum box fuselage construction, the Sonex can accept various lightweight – less than 200 lb – engines of between 80 to 130 hp. The Sonex, Waiex and Xenos all qualify as American experimental light-sport aircraft (ELSA).

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Hangar 2

Key Points: **Training & Conference Room** a multi-functional room suitable for presentations, meetings and educational displays.

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The End